

D E C L A R A T I O N

I, TSUNEO KOBAYASHI, a Japanese Patent Attorney registered No.12864 of Okabe International Patent Office at No. 602, Fuji Bldg., 2-3, Marunouchi 3-chome, Chiyoda-ku, Tokyo, Japan, hereby declare that I have a thorough knowledge of Japanese and English languages, and that the attached pages contain a correct translation into English of the priority documents of Japanese Patent Application No.2003-129997 filed on May 8, 2003 in the name of CANON KABUSHIKI KAISHA.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made, are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 8<sup>th</sup> day of July, 2008

A handwritten signature in black ink, appearing to read 'Tsuneo Kobayashi', written over a horizontal line.

TSUNEO KOBAYASHI

PATENT OFFICE  
JAPANESE GOVERNMENT

This is to certify that the annexed is a true copy of the following application  
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Date of Application: May 8, 2003

Application Number: Japanese Patent Application No.2003-129997  
[ST.10/C]: [ JP2003-129997 ]

Applicant(s): CANON KABUSHIKI KAISHA

June 10, 2004

Commissioner,  
Patent Office

YASUO IMAI (Seal)

Certificate No. 2004-3050070

2003-129997

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1. Date of Change: August 30, 1990  
(Reason of Change) New Registration  
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2004-3050070

日本国特許庁  
JAPAN PATENT OFFICE

PCT/JP 2004/006348

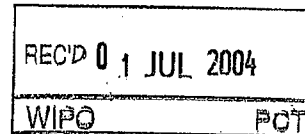
30. 4. 2004

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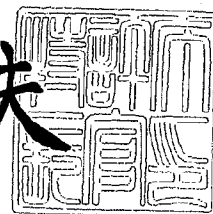
出願人  
Applicant(s): キヤノン株式会社

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2004年 6月10日

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Commissioner,  
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今井康夫



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SHINICHIRO OHTA

[International Classification] C09D 11/00

[Title of the Invention] Polymerizable compound, polymer compound, and composition, image formation method and image formation apparatus using the same

[Number of the Claims] 11

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[Material] Drawings 1

[Material] Abstract 1

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2003-129997

[Name of the Document] Claims and Specification

[Title of the Invention] Polymerizable compound,  
polymer compound, and composition, image formation

5 method and image formation apparatus using the same

[Claims]

[Claim 1]

A polymerizable compound represented by the  
general formula (1):

10 [General Formula (1)]



(1)

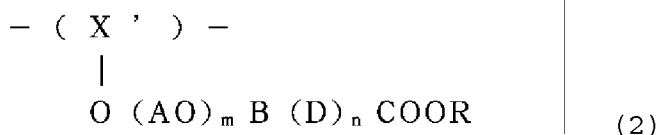
wherein X represents an alkenyl group; each A  
represents independently a linear or branched alkylene  
group of 1 to 15 carbon atoms which may be substituted;

15 m represents an integer of 0 to 30; B represents a  
single bond or an alkylene group which may be  
substituted; each D represents independently an  
aromatic ring in which at least one hydrogen atom  
attached to the ring is replaced by a fluorine atom; n  
20 represents an integer of 1 to 10; and R represents a  
hydrogen atom, an alkyl group which may be substituted,  
or an aromatic ring which may be substituted.

[Claim 2]

A polymer compound which has a repeating unit  
25 structure represented by the general formula (2);

[General Formula (2)]

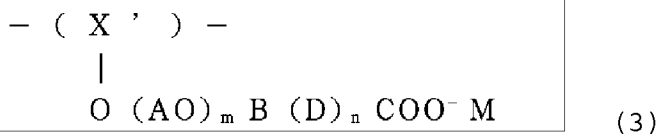


wherein X' represents a polyalkenyl group; each A represents independently a linear or branched alkylene group of 1 to 15 carbon atoms which may be substituted;  
 5 m represents an integer of 0 to 30; B represents a single bond or an alkylene group which may be substituted; each D represents independently an aromatic ring in which at least one hydrogen atom attached to the ring is displaced by a fluorine atom; n  
 10 represents an integer of 1 to 10; and R represents a hydrogen atom, an alkyl group which may be substituted, or an aromatic ring which may be substituted.

[Claim 3]

A polymer compound which has a repeating unit  
 15 structure represented by the general formula (3);

[General Formula (3)]



wherein X' represents a polyalkenyl group; each A represents independently a linear or branched alkylene group of 1 to 15 carbon atoms which may be substituted;  
 20 m represents an integer of 0 to 30; B represents a single bond or an alkylene group which may be substituted; each D represents independently an

aromatic ring in which at least one hydrogen atom attached to the ring is displaced by a fluorine atom; n represents an integer of 1 to 10; and M represents a monovalent or polyvalent metal cation.

5 [Claim 4]

A composition comprising a polymer compound having the repeating unit structure represented by the general formula (2) or (3).

[Claim 5]

10 A recording material comprising a solvent or dispersion medium, a coloring material, and the polymer compound having the repeating unit structure represented by the general formula (2) or (3).

[Claim 6]

15 A toner composition comprising a dispersion medium, a coloring material, and the polymer compound having the repeating unit structure represented by the general formula (2) or (3).

[Claim 7]

20 An ink composition comprising a solvent, a coloring material, and the polymer compound having the repeating unit structure represented by the general formula (2) or (3).

[Claim 8]

25 An image formation method comprising using the composition according to any one of claims 4 to 7.

[Claim 9]

A liquid application method comprising recording by application of the composition according to claim 4, 5 or 7 by ink jet recording.

[Claim 10]

5           An image formation apparatus used for the image formation method according to claim 8.

[Claim 11]

An image formation apparatus used for the liquid application method according to claim 9.

10   [Detailed Description of the Invention]

[0001]

[Technical Field to which the Invention Belongs]

The present invention relates to a polymerizable compound and a polymer compound which are novel and are  
15   useful as various functional materials, a composition using then, and an image formation method and apparatus using the above composition. Particularly preferably, it relates to an ink composition and a toner composition in which these compounds are used with a  
20   solvent or dispersion medium and a coloring material, and various image formation methods and apparatuses using these compositions.

[0002]

[Background Art]

25           Conventionally, it has been conducted to dissolve or disperse a coloring material so as to prepare an ink composition or toner composition. In the preparation of

these compositions, various polymer materials are favorably used. For example, polymer compounds such as styrylic, acrylic and methacrylic compounds are used.

With regard to a coloring material composition

5 comprising a solvent or water as a base material, an attempt has generally been made that a polymer material preferably comprising an ionic functional group is used, so as to improve dispersibility of coloring materials such as pigments.

10 [0003]

On the other hand, a polymer compound having a polyalkenyl ether main chain is also known as a polymer material having a soft polymer chain. However, introduction of an ionic functional group into a

15 repeating unit of the polymer compound has been hardly conducted. There is a slight description in Non-Patent Document 1 that carboxylic acid and ethers thereof are possible compounds. However, under present conditions, with respect to its stability, a compound which is  
20 further more stable than the existing ones is being sought for. In addition, compounds having various characteristics are also being sought for.

[0004]

[Non-Patent Document 1]

25 "Journal of Polymer Science Part A, Polymer Chemistry"  
Vol. 27, pp. 3303 to 3314, 1989

[0005]

[Problems to be Solved by the Invention]

The present invention has been accomplished in view of the above mentioned circumstances. Accordingly, the present invention aims to provide a polymer  
5 compound which is favorably used to improve the dispersion property of a coloring material and a solid matter in ink composition and toner composition.

The present invention also aims to provide a polymerizable compound which is required for the  
10 production of the above mentioned polymer compound and is stable and novel.

The present invention further aims to provide image formation method and apparatus using recording materials such as ink composition and toner composition  
15 using the above mentioned polymer compound.

[0006]

[Means for Solving the Problems]

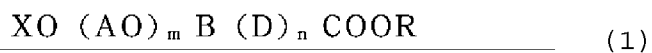
The present inventors have conducted intensive studies regarding the above prior art techniques and  
20 problems, thereby completing the present invention described below.

[0007]

According to a first aspect of the present invention, there is provided a polymerizable compound  
25 represented by the general formula (1):

[0008]

[General Formula (1)]



[0009]

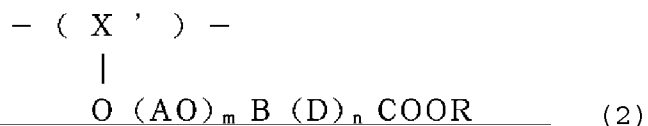
wherein X represents an alkenyl group; each A represents independently a linear or branched alkylene  
 5 group of 1 to 15 carbon atoms which may be substituted;  
 m represents an integer of 0 to 30; B represents a single bond or an alkylene group which may be substituted; each D represents independently an aromatic ring in which at least one hydrogen atom  
 10 attached to the ring is replaced by a fluorine atom; n represents an integer of 1 to 10; and R represents a hydrogen atom, an alkyl group which may be substituted, or an aromatic ring which may be substituted.

[0010]

15 According to a second aspect of the present invention, there is provided a polymer compound having a repeating unit structure represented by the general formula (2):

[0011]

20 [General Formula (2)]



[0012]

wherein X' represents a polyalkenyl group; each A represents independently a linear or branched alkylene

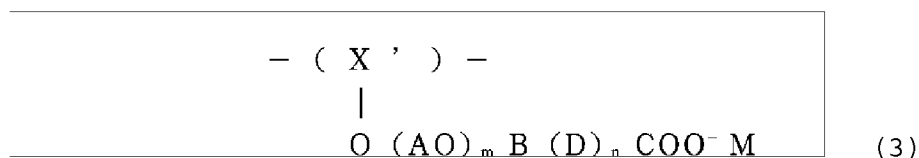
group of 1 to 15 carbon atoms which may be substituted;  
 m represents an integer of 0 to 30; B represents a  
 single bond or an alkylene group which may be  
 substituted; each D represents independently an  
 5 aromatic ring in which at least one hydrogen atom  
 attached to the ring is displaced by a fluorine atom; n  
 represents an integer of 1 to 10; and R represents a  
 hydrogen atom, an alkyl group which may be substituted,  
 or an aromatic ring which may be substituted.

10 [0013]

According to a third aspect of the present  
 invention, there is provided a polymer compound having  
 a repeating unit structure represented by the following  
 general formula (3);

15 [0014]

[General Formula (3)]



[0015]

wherein X' represents a polyalkenyl group; each A  
 20 represents independently a linear or branched alkylene  
 group of 1 to 15 carbon atoms which may be substituted;  
 m represents an integer of 0 to 30; B represents a  
 single bond or an alkylene group which may be  
 substituted; each D represents independently an  
 25 aromatic ring in which at least one hydrogen atom

attached to the ring is displaced by a fluorine atom; n represents an integer of 1 to 10; and M represents a monovalent or polyvalent metal cation.

[0016]

5           According to a fourth aspect of the present invention, there is provided a composition including a polymer compound having the repeating unit structure represented by the above mentioned general formula (2) or (3).

10       [0017]

          According to a fifth aspect of the present invention, there is provided a recording material including a solvent or dispersion medium, a coloring material, and the polymer compound having the repeating  
15       unit structure represented by the above mentioned general formula (2) or (3).

[0018]

          According to the present invention, there is also provided a toner composition including a dispersion  
20       medium, a coloring material, and the polymer compound having the repeating unit structure represented by the above mentioned general formula (2) or (3).

[0019]

          According to the present invention, there is  
25       further provided an ink composition including a solvent, a coloring material, and the polymer compound having the repeating unit structure represented by the above

mentioned general formula (2) or (3).

[0020]

According to a sixth aspect of the present invention, there are provided an image formation method  
5 and a liquid application method each using the above mentioned composition.

It is preferable to record an image with the ink composition by ink jet recording.

According to a seventh aspect of the present  
10 invention, there is provided an image formation apparatus used for the above mentioned image formation method and liquid application method.

[0021]

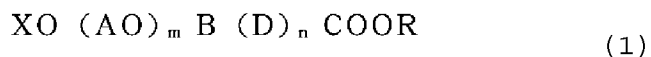
[Embodiments of the Invention]

15 The present invention will be described in detail below.

A polymerizable compound according to the first aspect of the present invention is a compound represented by the general formula (1):

20 [0022]

[General Formula (1)]



[0023]

wherein X represents an alkenyl group; each A  
25 represents independently a linear or branched alkylene group of 1 to 15 carbon atoms which may be substituted;

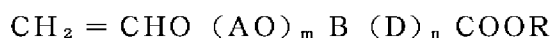
m represents an integer of 0 to 30; B represents a single bond or an alkylene group which may be substituted; each D represents independently an aromatic ring in which at least one hydrogen atom  
 5 attached to the ring is replaced by a fluorine atom; n represents an integer of 1 to 10; and R represents a hydrogen atom, an alkyl group which may be substituted, or an aromatic ring which may be substituted.

Preferred examples of the alkenyl group include  
 10 ethynyl, propenyl, butenyl, pentenyl and hexenyl.  
 [0024]

The preferred is a compound represented by the following general formula (4):

[0025]

15 [General Formula (4)]



[0026]

In the above general formula (4), A represents a linear or branched alkylene group of 1 to 15 carbon  
 20 atoms, preferably 2 to 10 carbon atoms, which may be substituted. Examples of the substituent for the alkylene group include methyl, ethyl, propyl and phenyl.

[0027]

In the above general formula (4), m represents an  
 25 integer of 0 to 30, preferably 1 to 10. When m is 2 or more, the respective A's may be the same or different

from each other.

In the above general formula (4), B represents a single bond or an alkylene group which may be substituted. Examples of such an alkylene group include  
5 methylene, ethylene, propylene, butylenes, pentylene, hexylene, heptylene and octylene.

[0028]

In the above general formula (4), D represents an aromatic ring in which at least one hydrogen atom  
10 attached to the ring is displaced by a fluorine atom. Examples of such an aromatic ring include phenyl, pyridylene, pyrimidyl, naphthyl, anthranyl, phenanthranyl, thiophenyl and furanyl. The types of substitution include monofluoro substitution, difluoro  
15 substitution, trifluoro substitution, tetrafluoro substitution, and substitution with more numbers of fluorine atoms such as 5, 6, 7 or 8 fluorine atoms.

[[0029]

In the above general formula (4), n represents an  
20 integer of 1 to 10, preferably of 1 to 5. When n is 2 or more, the respective D's may be the same or different from each other.

[0030]

In the above general formula (4), R represents a  
25 hydrogen atom, an alkyl group which may be substituted, or an aromatic ring which may be substituted. As the alkyl group, alkyl groups of 1 to 10 carbon atoms are

preferable. Examples of the aromatic ring include a phenyl group, a pyridyl group and a biphenyl group. Examples of the substituent include an alkyl group and an alkoxy group.

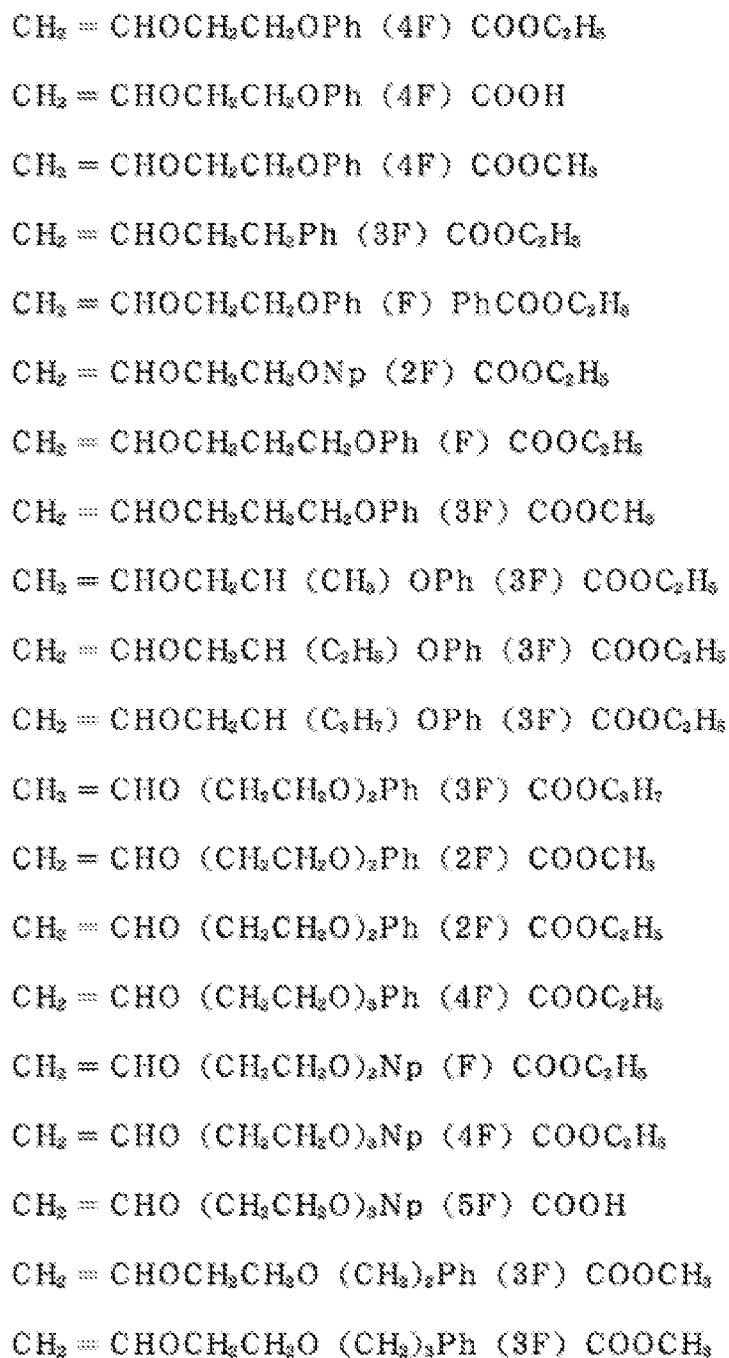
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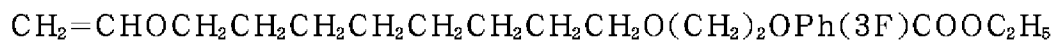
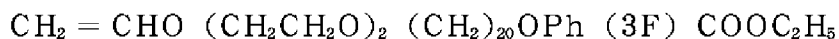
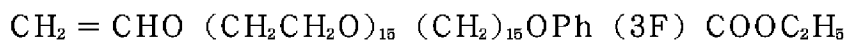
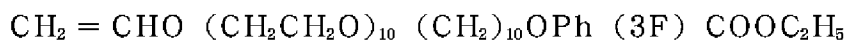
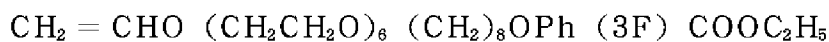
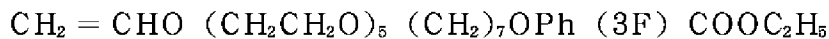
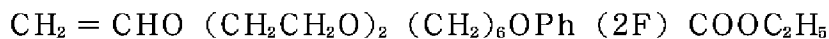
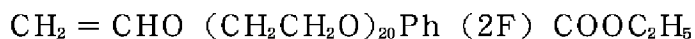
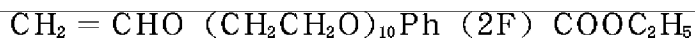
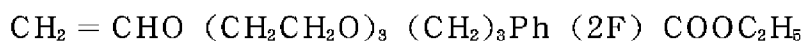
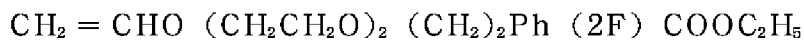
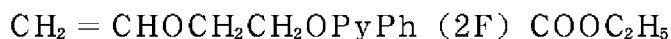
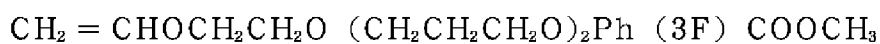
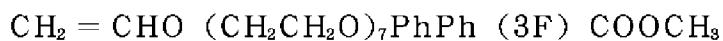
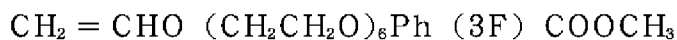
The fluorine-substituted aromatic carboxylic acids represented by the general formula (1) have acidities different from those of the aliphatic carboxylic acids and are therefore extremely useful in their feasibility  
10 of providing various functional polymer materials with different acidities as polymerizable compounds having the vinyl ether repeating units.

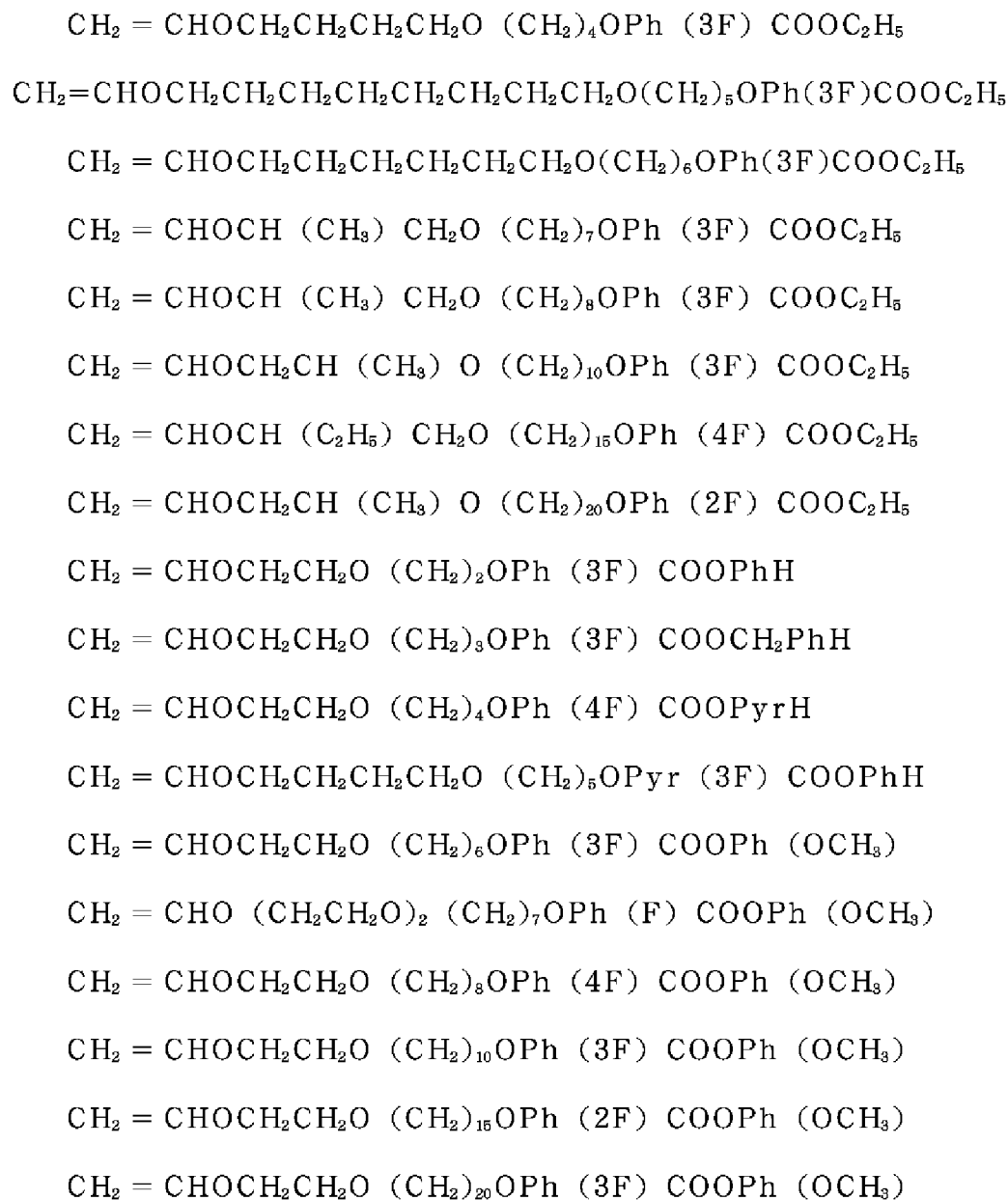
[0032]

Specific examples of the polymeric compound  
15 represented by the general formula (1) include the following compounds:

[0033]







[0036]

In the above examples, Ph represents 1,4-phenylene or 1,3-phenylene, Py represents 2,5-pyrimidylene, and

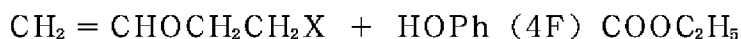
Pyr represents 2,5-pyridylene. Np represents 2,6-naphthylene, 1,4-naphthylene or 1,5-naphthylene. The expression Ph (F) represents 2- or 3-monofluoro substitution. The expression Ph (2F) represents 2,3-,  
 5 2,6-, 2,5- or 3,5-difluoro substitution. The expression Ph (3F) represents 2,3,5- or 2,3,6-trifluoro substitution. The expression Ph (4F) represents 2,3,5,6-tetrafluoro substitution. In the case of other aromatic ring structures also, the arabic numeral in  
 10 parentheses represents the number of fluorine atoms for substitution and indicates that the substitution is effected at any positions.

[0037]

As an example of the synthesizing method of the  
 15 polymeric compound represented by the general formula (1), there may be included an etherification method shown by the following reaction formula (1):

[0038]

[Reaction Formula (1)]



20

[0039]

wherein X represents a halogen atom.

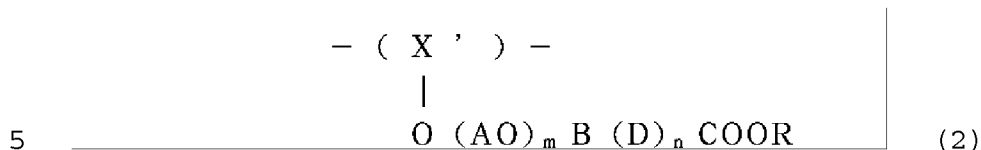
[0040]

Next, the second aspect of the present invention

is a polymer compound having the repeating unit structure represented by the general formula (2):

[0041]

[General Formula (2)]



[0042]

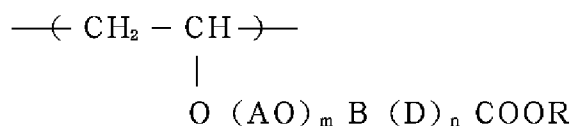
wherein X' represents a polyalkenyl group; each A represents independently a linear or branched alkylene group of 1 to 15 carbon atoms which may be substituted;  
 10 m represents an integer of 0 to 30; B represents a single bond or an alkylene group which may be substituted; each D represents independently an aromatic ring in which at least one hydrogen atom attached to the ring is displaced by a fluorine atom; n  
 15 represents an integer of 1 to 10; and R represents a hydrogen atom, an alkyl group which may be substituted.

[0043]

The repeating unit structure represented by the general formula (2) is preferably a unit structure  
 20 represented by the following general formula (5):

[0044]

[General Formula (5)]



[0045]

wherein each A represents independently a linear or branched alkylene group of 1 to 15 carbon atoms which may be substituted; m represents an integer of 0 to 30;  
5 B represents a single bond or an alkylene group which may be substituted; each D represents independently an aromatic ring in which at least one hydrogen atom attached to the ring is displaced by a fluorine atom; n represents an integer of 1 to 10; and R represents a  
10 hydrogen atom, an alkyl group which may be substituted, or an aromatic ring structure which may be substituted.

[0046]

Incidentally, it is to be noted that preferred ranges and specific examples of A, m, B, D, n and R are  
15 the same as those described for the above general formula (1).

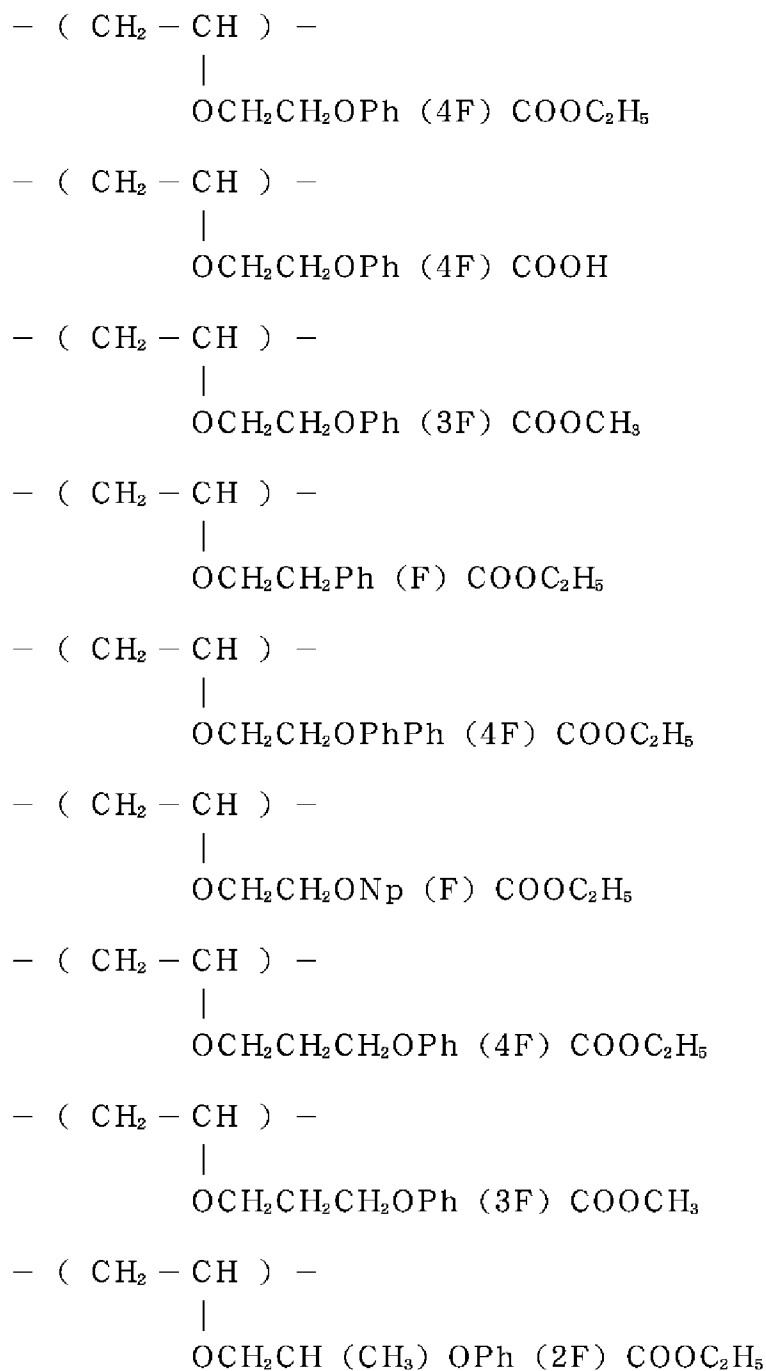
[0047]

The general formula (5) in accordance with the present invention is characterized by having the  
20 fluorine-substituted aromatic carboxylic acid derivative at a terminal thereof. The fluorine-substituted aromatic carboxylic acids have acidities different from those of the aliphatic carboxylic acids and are therefore extremely useful in their feasibility  
25 of providing various functional polymer materials with different acidities as polymerizable compounds having the vinyl ether repeating units.

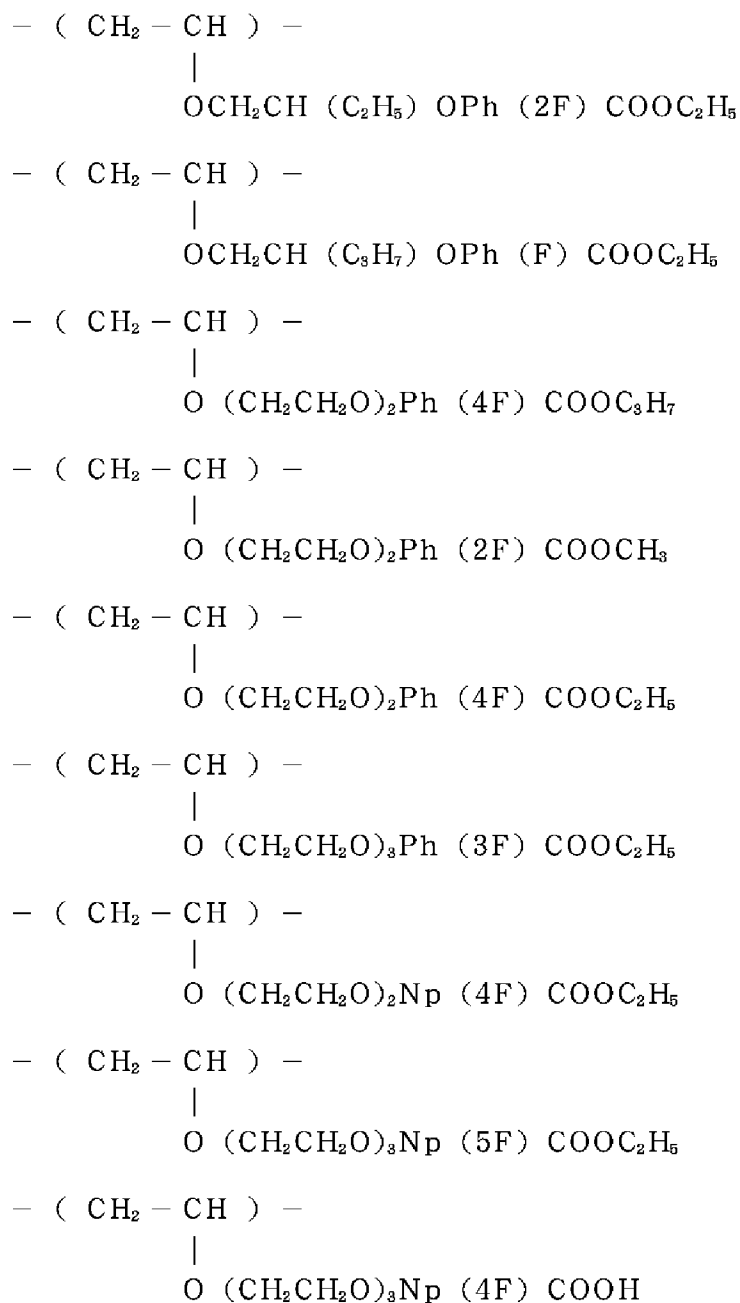
[0048]

Specific examples of the repeating unit structure represented by the general formula (2) include the following unit structures:

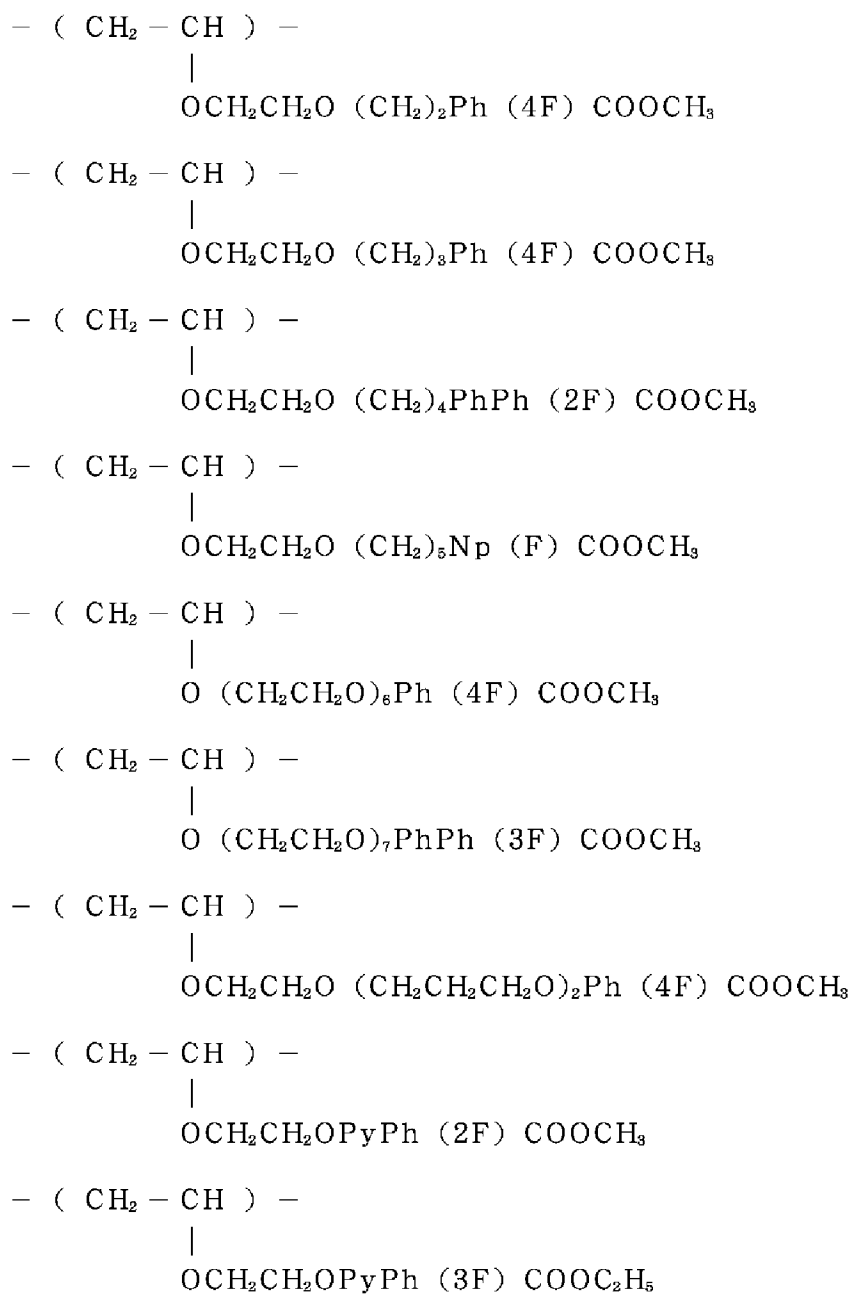
5 [0049]

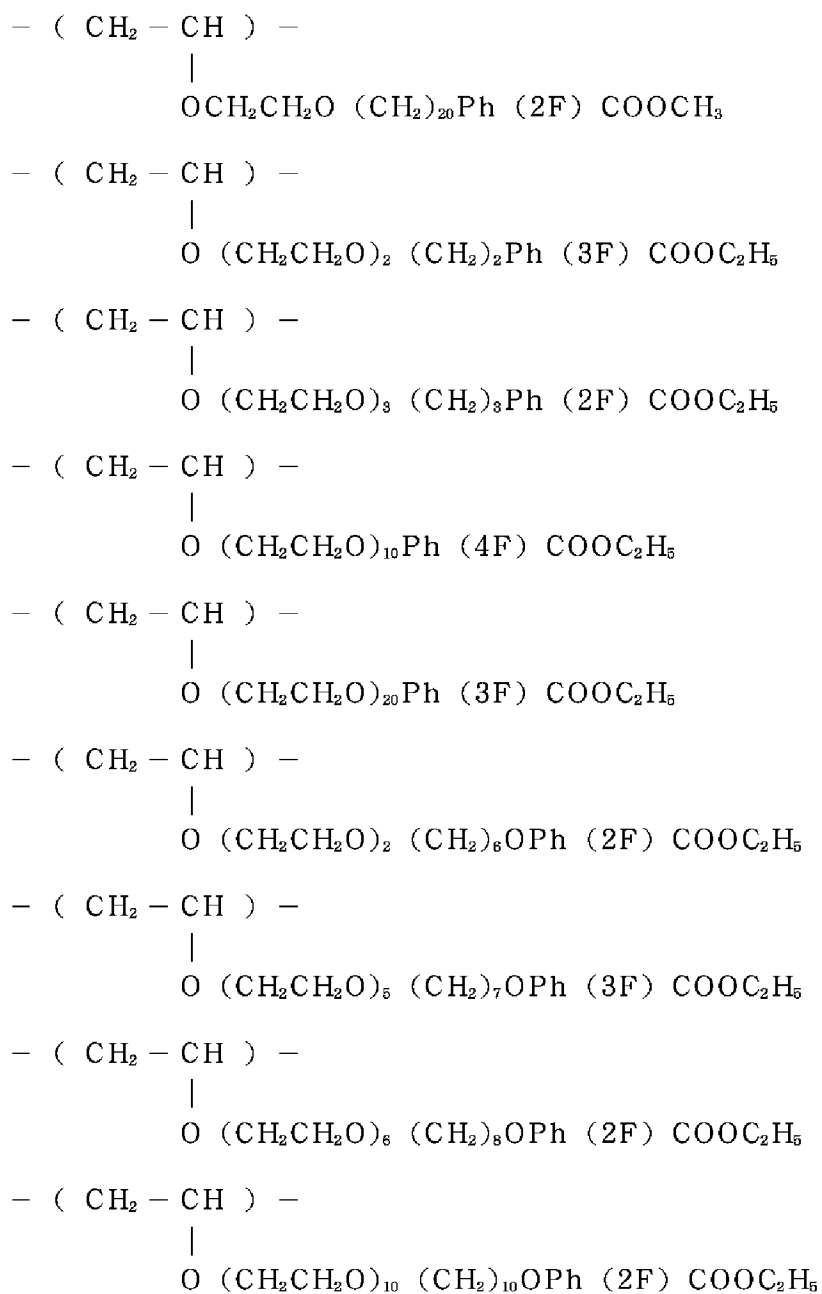


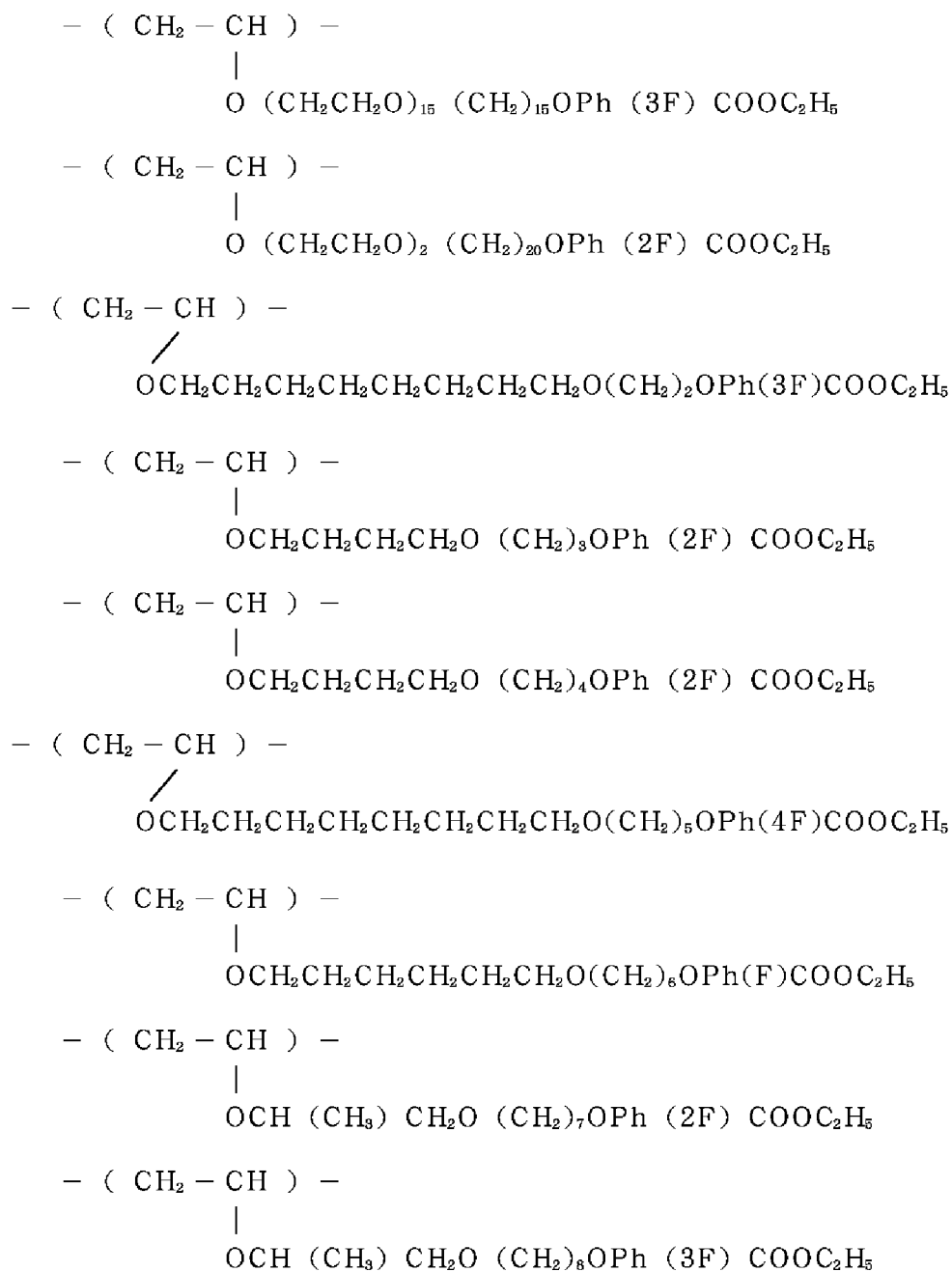
[0050]

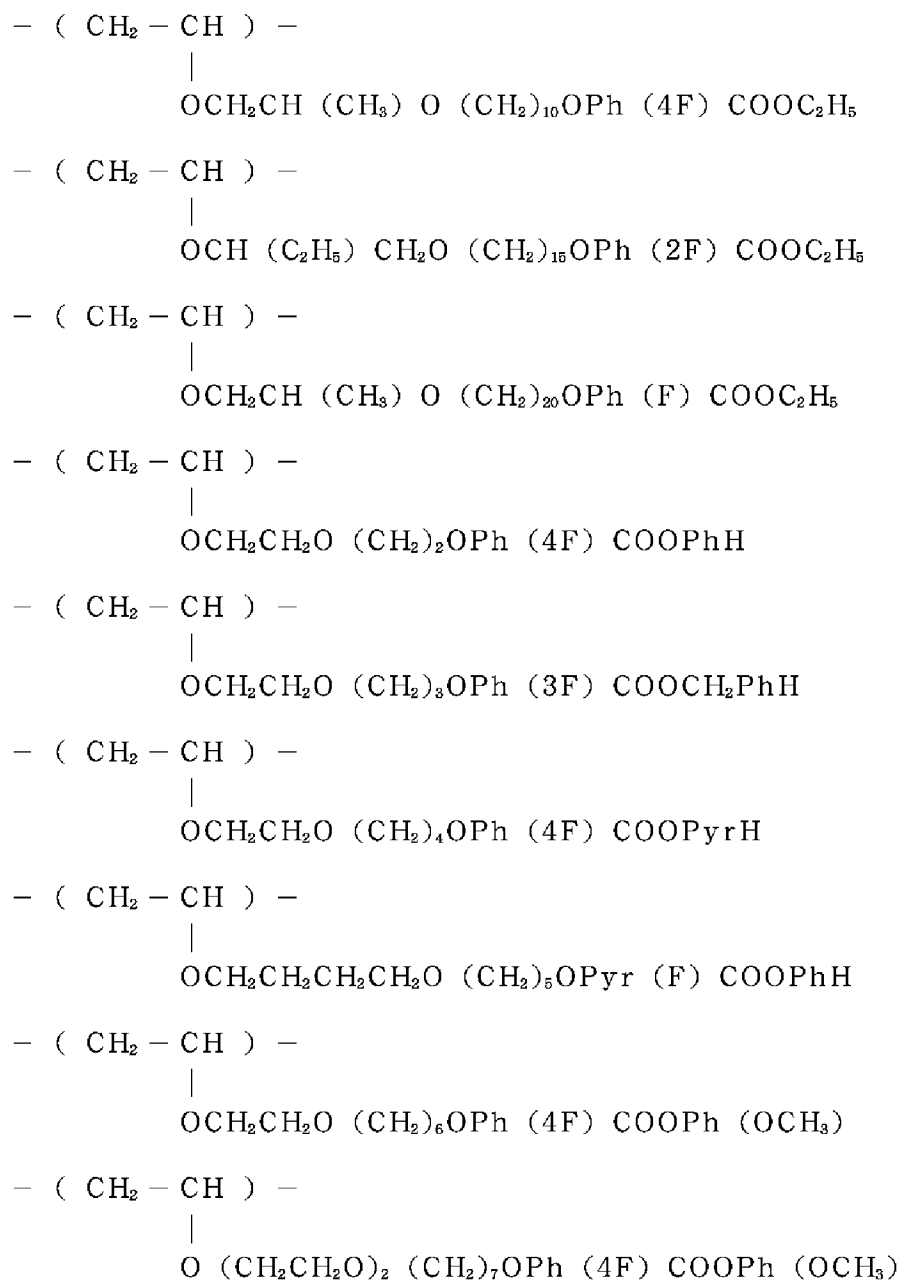


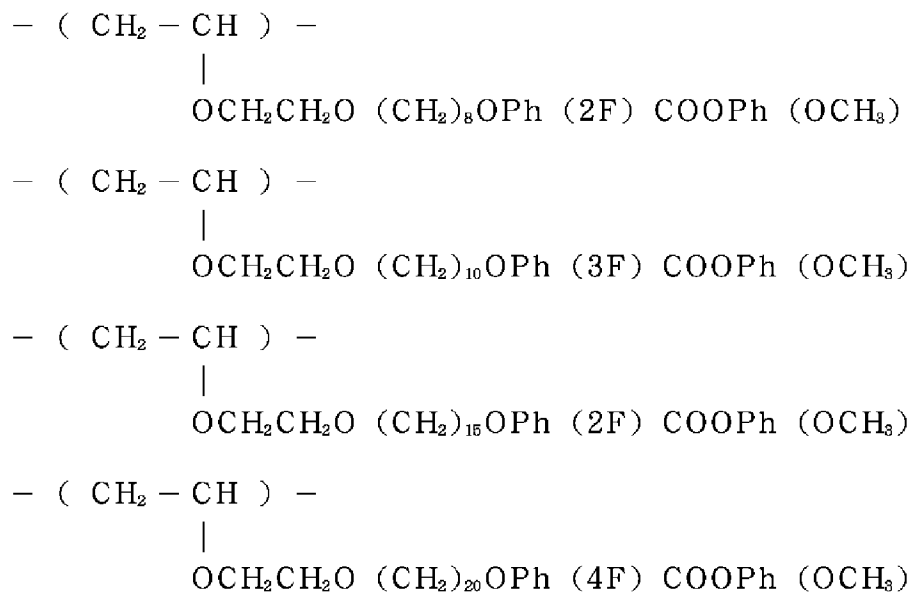
[0051]











[0056]

In the above examples, Ph represents 1,4-phenylene  
 or 1,3-phenylene, Py represents 2,5-pyrimidylene, and  
 5 Pyr represents 2,5-pyridylene. Np represents 2,6-  
 naphthylene, 1,4-naphthylene or 1,5-naphthylene. The  
 expression Ph (F) represents 2- or 3-monofluoro  
 substitution. The expression Ph (2F) represents 2,3-,  
 2,6-, 2,5- or 3,5-difluoro substitution. The expression  
 10 Ph (3F) represents 2,3,5- or 2,3,6-trifluoro  
 substitution. The expression Ph (4F) represents  
 2,3,5,6-tetrafluoro substitution. In the case of other  
 aromatic ring structures also, the arabic numeral in  
 parentheses represents the number of fluorine atoms for  
 15 substitution and indicates that the substitution is

effected at any positions.

[0057]

The polymerizable compound having the repeating unit structure represented by the above general formula (2) can preferably be obtained by polymerizing the polymeric compound represented by the above general formula (1). The polymerization herein is mainly a cationic polymerization. Examples of an initiator used herein include a protonic acid such as hydrochloric acid, sulfuric acid, methanesulfonic acid, trifluoroacetic acid, trifluoromethanesulfonic acid or perchloric acid, or a combination of a Lewis acid such as  $\text{BF}_3$ ,  $\text{AlCl}_3$ ,  $\text{TiCl}_4$ ,  $\text{SnCl}_4$ ,  $\text{FeCl}_3$ ,  $\text{RAlCl}_2$  or  $\text{R}_{1.5}\text{AlCl}_{1.5}$  (wherein R represents alkyl) with a cation source (wherein examples of such a cation source include a protonic acid, and an adduct obtained from water, alcohol, vinyl ether and a carboxylic acid). By making such an initiator coexist with the polymeric compound (monomer) represented by the general formula (1), a polymerization reaction will proceed to synthesize the polymerizable compound.

[0058]

The number-average molecular weight of the polymer of the present invention having the repeating unit structure represented by the general formula (2) is generally not less than 200 but no more than 10,000,000, and preferably not less than 1,000 but no more than

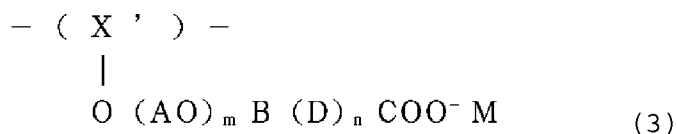
1,000,000. If the number-average molecular weight exceeds 10,000,000, it causes too much entanglement or twisting in a polymer chain or between polymer chains, and it might become difficult for the polymer to be dispersed in a solvent. In contrast, if the number-average molecular weight is less than 200, the molecular weight is so small that a steric effect as a polymer might be hardly obtained. The polymer of the present invention may be either a homopolymer consisting of a single kind repeating unit structure, or copolymer consisting of multiple kinds of repeating unit structures. The repeating unit structure represented by the general formula (2) may be contained in the polymer preferably in an amount of 10 mol% or more. In addition, the content of the polyalkenyl ether repeating unit structure may also be preferably 50 mol% or more, and more preferably 80 mol% or more.

[0059]

Moreover, the polymer of the present invention is a polymer having a repeating unit structure represented by the following general formula (3):

[0060]

[General Formula (3)]



[0061]

wherein X' represents a polyalkenyl group; each A represents independently a linear or branched alkylene group of 1 to 15 carbon atoms which may be substituted; m represents an integer of 0 to 30; B represents a  
 5 single bond or an alkylene group which may be substituted; each D represents independently an aromatic ring in which at least one hydrogen atom attached to the ring is displaced by a fluorine atom; n represents an integer of 1 to 10; and M represents a  
 10 monovalent or polyvalent metal cation.

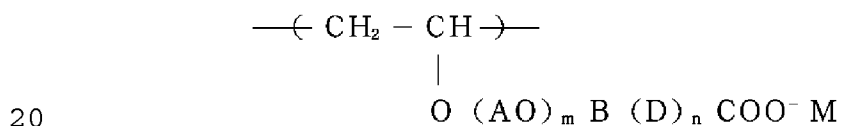
Preferred examples of the polyalkenyl include polyethynyl, polypropenyl, polybutenyl, polypentenyl and polyhexenyl.

[0062]

15 The repeating unit structure represented by the general formula (3) is preferably a unit structure represented by the following general formula (6):

[0063]

[General Formula (6)]



[0064]

wherein each A represents independently a linear or branched alkylene group of 1 to 15 carbon atoms which may be substituted; m represents an integer of 0 to 30;  
 25 B represents a single bond or an alkylene group which

may be substituted; each D represents independently an aromatic ring in which at least one hydrogen atom attached to the ring is displaced by a fluorine atom; n represents an integer of 1 to 10; and M represents a monovalent or polyvalent metal cation.

[0065]

It is to be noted that preferred ranges and specific examples of A, m, B, D and n are the same as those described for the above general formula (1).

10 [0066]

In the above general formula (7), M represents a monovalent or polyvalent metal cation. Specific examples of M as a monovalent metal cation include sodium, potassium and lithium. Specific examples of M as a polyvalent metal cation include magnesium, calcium, nickel and iron. When M represents a polyvalent metal cation, M forms counterions for two or more  $\text{COO}^-$  groups as anions.

[0067]

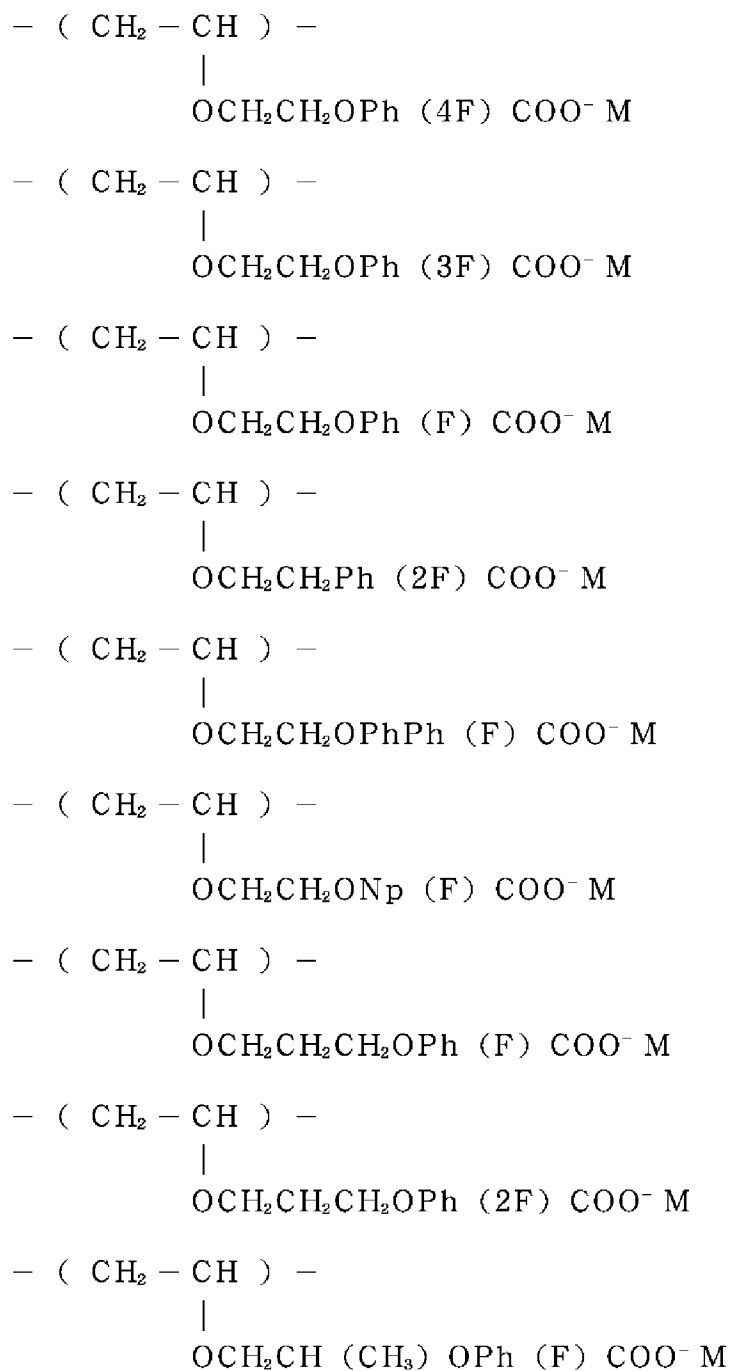
20 The polymer of the present invention having the repeating unit structure represented by the general formula (3) can be obtained by subjecting to alkaline hydrolysis or alkaline neutralization, a terminal ester portion of a corresponding polymer having the repeating unit structure represented by the above general formula (2). It is also possible to obtain the above polymer of the present invention by hydrolysis with an acid

followed by alkaline treatment. However, the former method is preferable.

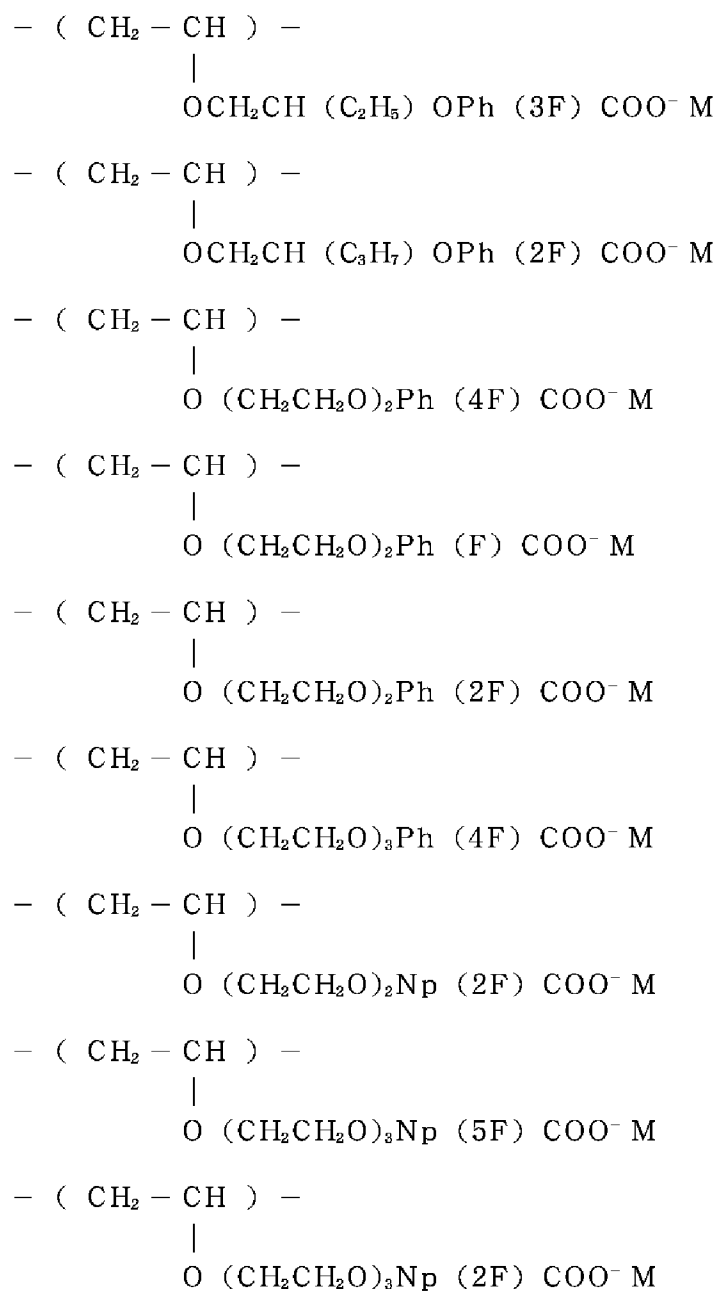
[0068]

Specific examples of the repeating unit structure  
5 represented by the general formula (3) include the following unit structures:

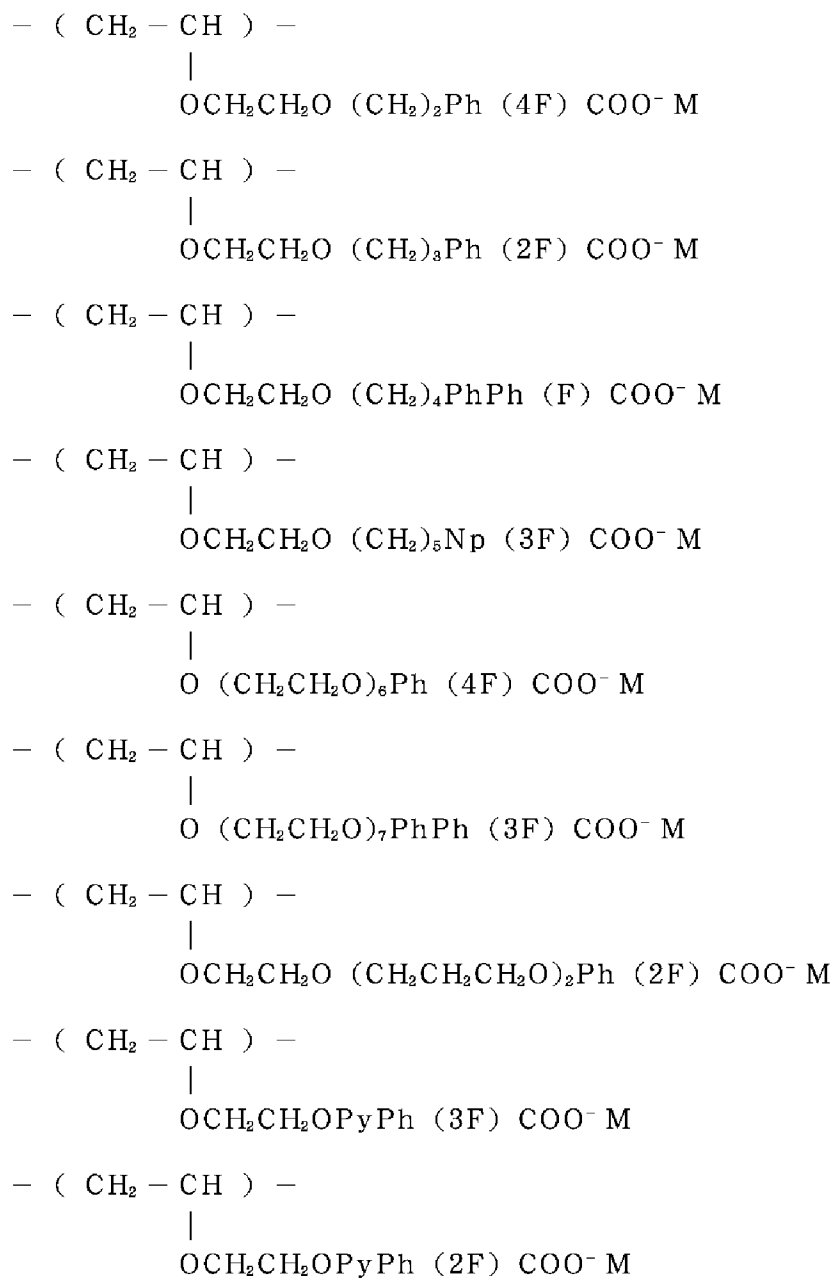
[0069]

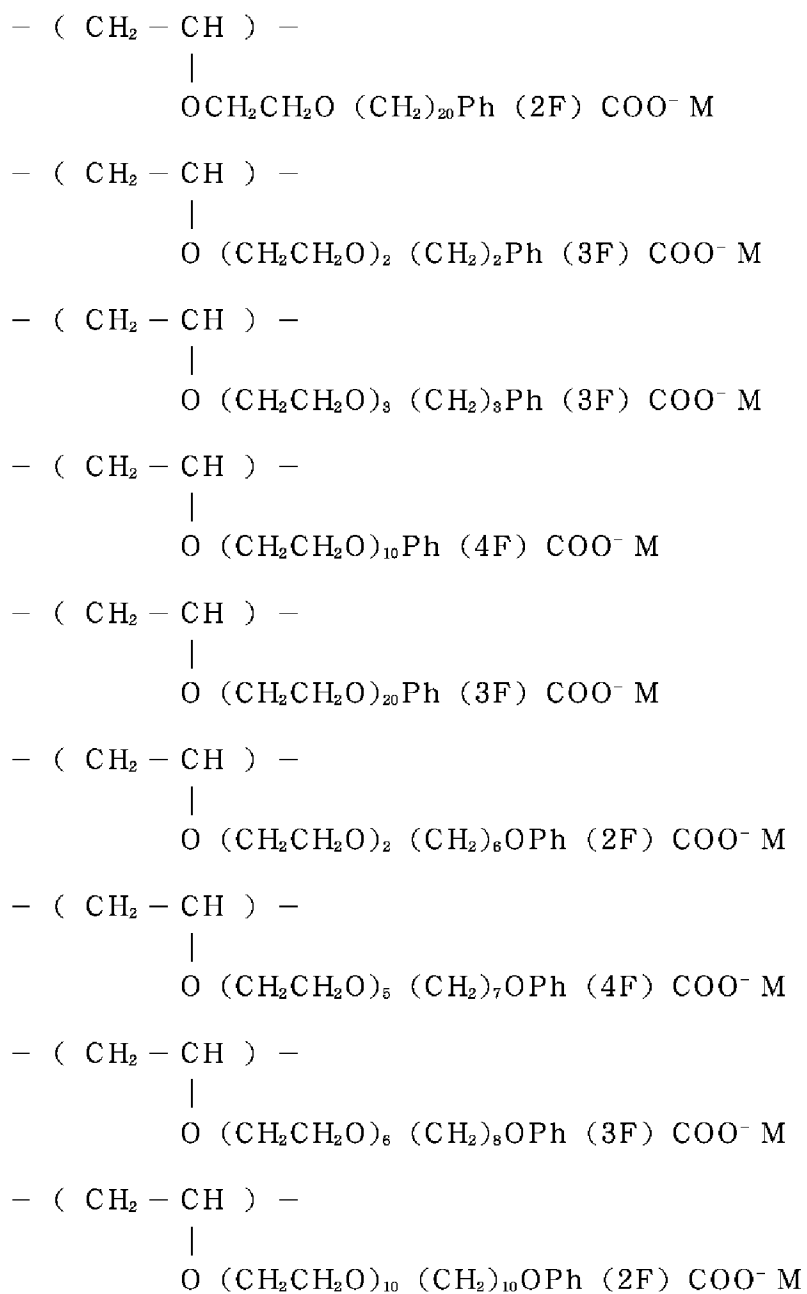


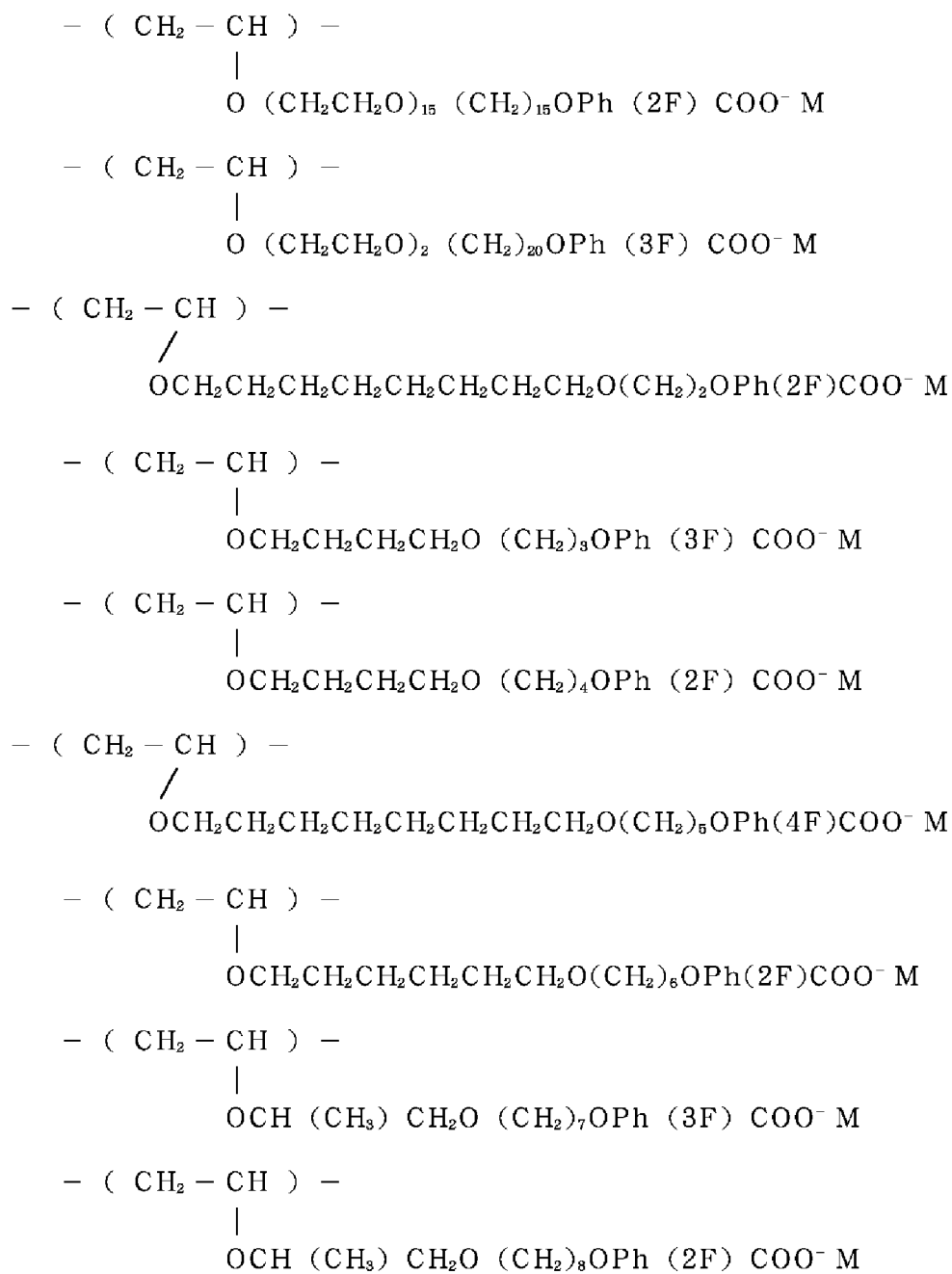
[0070]

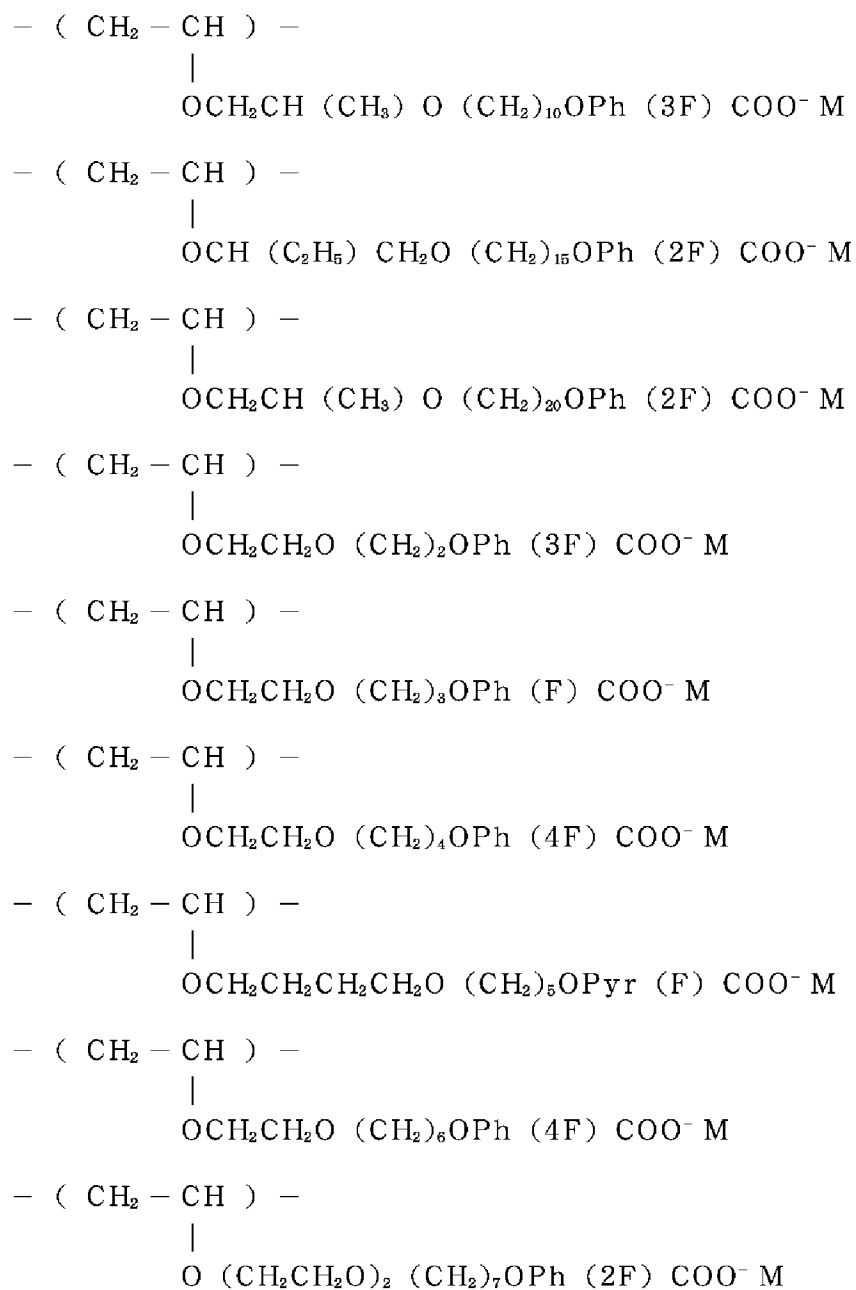


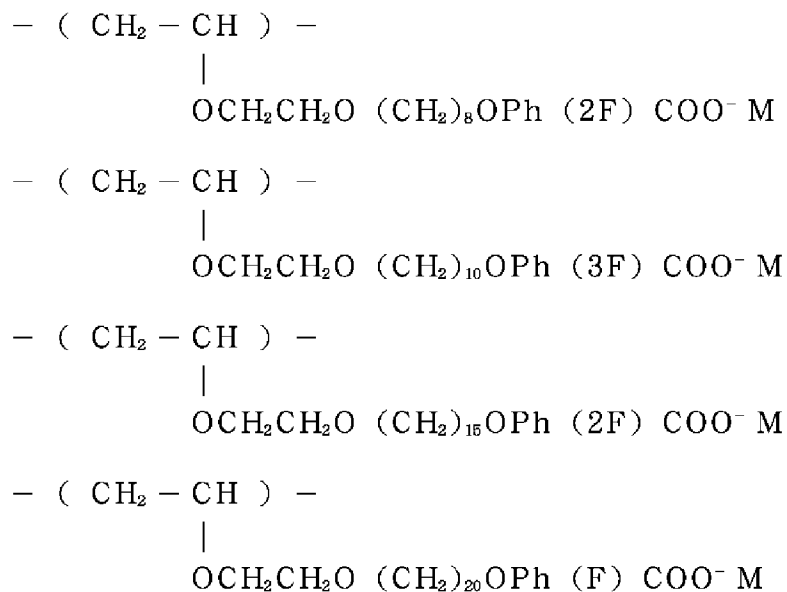
[0071]











[0076]

In the above examples, Ph represents 1,4-phenylene or 1,3-phenylene, Py represents 2,5-pyrimidylene, and  
 5 Pyr represents 2,5-pyridylene. Np represents 2,6-naphthylene, 1,4-naphthylene or 1,5-naphthylene. The expression Ph (F) represents 2- or 3-monofluoro substitution. The expression Ph (2F) represents 2,3-, 2,6-, 2,5- or 3,5-difluoro substitution. The expression  
 10 Ph (3F) represents 2,3,5- or 2,3,6-trifluoro substitution. The expression Ph (4F) represents 2,3,5,6-tetrafluoro substitution. In the case of other aromatic ring structures also, the arabic numeral in parentheses represents the number of fluorine atoms for  
 15 substitution and indicates substitution is effected at

any positions.

[0077]

The number-average molecular weight of the polymer of the present invention having the repeating unit structure represented by the general formula (3) is generally not less than 200 but no more than 10,000,000, and preferably not less than 1,000 but no more than 1,000,000. If the number-average molecular weight is more than 10,000,000, it causes too much entanglement or twisting in a polymer chain or between polymer chains, and it might become difficult for the polymer to be dispersed in a solvent. In contrast, if the number-average molecular weight is less than 200, the molecular weight is so small that a steric effect as a polymer might be hardly obtained. The polymer of the present invention may be either a homopolymer consisting of a single kind repeating unit structure, or copolymer consisting of multiple kinds of repeating unit structures.

20 [0078]

Also, the second aspect of the present invention is a composition including the polymer compound having the repeating unit structure represented by the above mentioned general formula (2) or (3).

25 [0079]

The composition of the present invention preferably contains any one of the above described

polymers compounds, a coloring material, a functional substance having a predetermined useful function. The polymerizable compound can preferably be used to well disperse the coloring material, the functional  
5 substance or the like. It is also possible to use a pigment, metal, herbicide, insecticide, or biological material such as a medicine. In addition, the above polymer compounds represented by the general formula (2) and (3) of the present invention may also be used  
10 as good water-soluble polymer compounds. Further, since the polymers can also be used as adhesives or tacking agents, the polymers do not always need to contain a functional substance.

[0080]

15 The functional substance may preferably be used in an amount of 0.1 to 50 mass% based on the total mass of the composition of the present invention. Further, it may also be a soluble substance, and dyes, molecular catalysts, and the like may also be used as the  
20 functional substance.

[0081]

Moreover, the polymer compound having the repeating unit structure represented by the general formula (2) or (3) is preferably contained in the  
25 composition of the present invention in an amount of 0.5 to 98 mass% based on the total mass of the composition.

[0082]

A preferred example of the composition of the present invention may be a recording material containing a solvent or dispersion medium, a coloring  
5 material and the above-mentioned polymer compound having the repeating unit structure represented by the general formula (2) or (3).

[0083]

Specific examples of such a recording medium may  
10 be a toner composition containing a dispersion medium such as a binder resin, a coloring material and the above-mentioned polymer compound having the repeating unit structure represented by the general formula (2) or (3), and an ink composition containing a solvent, a  
15 coloring material and the above polymerizable compound having the repeating unit structure represented by the general formula (2) or (3).

[0084]

An ink composition that is a preferred embodiment  
20 of the present invention will be described below.

The content of the above-described polymer compound having the repeating unit structure represented by the general formula (2) or (3) in the ink composition of the present invention is within the  
25 range of 0.1 to 90 mass%, preferably 1 to 80 mass%. When used for ink-jet printers, the content of the polymerizable compound is preferably within the range

of 1 to 30 mass%.

[0085]

Next, components other than the above-mentioned polymerizable compounds contained in the ink

5 composition of the present invention will be described in detail below. Examples of other components include organic solvents, water, water-soluble solvents, coloring materials and additives.

[0086]

10 [Organic Solvents]

Examples of the organic solvent include hydrocarbons solvent, aromatic solvents, ether solvents, ketone solvents, ester solvents and amide solvents.

[0087]

15 [Water]

As water, ion exchange water, pure water and extra pure water wherein metal ions are eliminated are preferable used in the present invention.

[0088]

20 [Aqueous Solvents]

Examples of the aqueous solvent used in the invention include: polyvalent alcohols such as ethylene glycol, diethylene glycol, triethylene glycol, polyethylene glycol, propylene glycol, polypropylene  
25 glycol or glycerol; polyvalent alcohol ethers such as ethylene glycol monomethyl ether, ethylene glycol monoethyl ether, ethylene glycol monobutyl ether,

diethylene glycol monoethyl ether or diethylene glycol monobutyl ether; and nitrogen-containing solvents such as N-methyl-2-pyrrolidone, substituted pyrrolidone or triethanolamine. In addition, monovalent alcohols such  
5 as methanol, ethanol or isopropyl alcohol can also be used to accelerate the drying of an aqueous dispersion on a recording medium.

[0089]

The total content of the organic solvent, water  
10 and aqueous solvent described above is preferably within the range of 20 to 95 mass%, more preferably 30 to 90 mass% based on the total mass of the ink composition of the present invention.

[0090]

15 [Coloring Materials]

Coloring materials such as pigments or dyes may be contained in the ink composition of the present invention with pigments being more preferably used.

[0091]

20 Specific examples of the pigments and dyes used in the ink composition are as follows.

The pigments may be either organic or inorganic pigments. A black pigment and pigments of three primary colors, cyan, magenta and yellow may preferably be used  
25 for the ink. Incidentally, color pigments other than those described above, colorless or pale-color pigments, metallic luster pigments, and the like may also be used.

Moreover, pigments which have been newly synthesized for the present invention may also be used.

[0092]

Examples of commercially available black, cyan,  
5 magenta and yellow pigments are shown below.

[0093]

Examples of the black pigment include, but are not limited to, Raven 1060, Raven 1080, Raven 1170, Raven 1200, Raven 1250, Raven 1255, Raven 1500, Raven 2000,  
10 Raven 3500, Raven 5250, Raven 5750, Raven 7000, Raven 5000 ULTRA11, and Raven 1190 ULTRA11 (manufactured by Colombian Carbon Co.), Black Pearls L, MOGUL-L, Regal400, Regal660R, Regal330R, Monarch 800, Monarch 880, Monarch 900, Monarch 1000, Monarch 1300, and  
15 Monarch 1400 (manufactured by Cabot Corp.), Color Black FW1, Color Black FW2, Color Black FW200, Color Black 18, Color Black S160, Color Black S170, Special Black 4, Special Black 4A, Special Black 6, Printex35, Printex U, Printex140U, Printex V, and Printex140V (manufactured  
20 by Degussa AG) and No. 25, No. 33, No. 40, No. 47, No. 52, No. 900, No. 2300, MCF-88, MA600, MA7, MA8 and MA100 (manufactured by Mitsubishi Chemical Corp.)

[0094]

Examples of the cyan pigment include, but are not  
25 limited to, C.I. Pigment Blue-1, C.I. Pigment Blue-2, C.I. Pigment Blue-3, C.I. Pigment Blue-15, C.I. Pigment Blue-15:2, C.I. Pigment Blue-15 : 3, C.I. Pigment Blue-

15 : 4 , C.I. Pigment Blue-16, C.I. Pigment Blue-22,  
C.I. Pigment Blue-60 and others.

[0095]

Examples of the magenta pigment include, but are  
5 not limited to, C.I. Pigment Red-5, C.I. Pigment Red-7,  
C.I. Pigment Red-12, C.I. Pigment Red-48, C.I. Pigment  
Red-48:1, C.I. Pigment Red-57, C.I. Pigment Red-122,  
C.I. Pigment Red-122, C.I. Pigment Red-123, C.I.  
Pigment Red-146, C.I. Pigment Red-168, C.I. Pigment  
10 Red-184, C.I. Pigment Red-202, C.I. Pigment Red-207 and  
others.

[0096]

Examples of the yellow pigment include, but are  
not limited to, C.I. Pigment Yellow-12, C.I. Pigment  
15 Yellow-13, C.I. Pigment Yellow-14, C.I. Pigment Yellow-  
16, C.I. Pigment Yellow-17, C.I. Pigment Yellow-74, C.I.  
Pigment Yellow-83, C.I. Pigment Yellow-93, C.I. Pigment  
Yellow-95, C. I. Pigment Yellow-97, C. I. Pigment  
Yellow-98, C. I. Pigment Yellow-114, C.I. Pigment  
20 Yellow-128, C.I. Pigment Yellow-129, C. I. Pigment  
Yellow-151, C. I. Pigment Yellow-154 and others.

[0097]

Moreover, pigments self-dispersible in water may  
also be used for the composition of the present  
25 invention. Such pigments dispersible in water include  
those of which dispersibility is enhanced utilizing a  
steric hindrance effect of a polymer adsorbed onto the

surface thereof, or an electrostatic repulsion.

Examples of such pigments that are commercially available include CAB-0-JET200, CAB-0-JET300 (both manufactured by Cabot Corp.), and Microjet Black CW-1  
5 (manufactured by Orient Chemical Corp.).

[0098]

The pigments used for the ink composition of the present invention are preferably contained in the amount of 0.1 to 50 mass% based on the total mass of  
10 the ink composition. If the content of pigment is less than 0.1 mass%, a sufficient image density cannot be obtained. In contrast, if the content of the pigment is more than 50 mass%, the fixation property of an image may be lowered. The content of the pigment is more  
15 preferably within the range of 0.5 to 30 mass%.

[0099]

Furthermore, the dyes may also be used for the ink composition of the present invention. Direct dyes, acid dyes, basic dyes, reactive dyes, water-soluble dyes for  
20 food pigments, insoluble pigments as disperse dye, and fat-soluble dyes can be used, which will be described below.

[0100]

Examples of the fat-soluble dyes include C. I.  
25 Solvent Blue -33, -38, -42, -45, -53, -65, -67, -70, -104, -114, -115, -135, C. I. Solvent Red -25, -31, -86, -92, -97, -118, -132, -160, -186, -187, -219, C. I.

Solvent Yellow -1, -49, -62, -74, -79, -82, -83, -89, -90, -120, -121, -151, -153, -154 and others.

Examples of the water-soluble dyes include

direct dyes such as C.I. Direct Black -17, -19, -22, -32, -38, -51, -62, -71, -108, -146, and -154, C.I. Direct Yellow -12, -24, -26, -44, -86, -87, -98, -100, -130, and -142, C.I. Direct Red -1, -4, -13, -17, -23, -28, -31, -62, -79, -81, -83, -89, -227, -240, -242 and -243, C.I. Direct Blue -6, -22, -25, -71, -78, -86, -90, -106 and -199, C.I. Direct Orange -34, -39, -44, -46, and -60, C.I. Direct Violet -47 and -48, C.I. Direct Brown -109, and C.I. Direct Green -59;

acid dyes such as C.I. Acid Black -2, -7, -24, -26, -31, -52, -63, -112, -118, -168, -172, and -208, C.I. Acid Yellow -11, -17, -23, -25, -29, -42, 49, -61, and -71, C.I. Acid Red -1, -6, -8, -32, -37, -51, -52, -80, -85, -87, -92, -94, -115, -180, -254, -256, -289, -315, and -317, C.I. Acid Blue -9, -22, -40, -59, -93, -102, -104, 113, -117, -120, -167, -229, -234 and -254, C.I. Acid Orange -7 and -19, and C.I. Acid Violet -49;

reactive dyes such as C.I. Reactive Black -1, -5, -8, -13, -14, -23, -31, -34, and -39, C.I. Reactive Yellow -2, -3, -13, -15, -17, -18, -23, -24, -37, -42, -57, -58, -64, -75, -76, -77, -79, -81, -84, -85, -87, -88, -91, -92, -93, -95, -102, -111, -115, -116, -130, -131, -132, -133, -135, -137, -139, -140, -142, -143, -

144, -145, -146, -147, -148, -151, -162 and -163, C.I. Reactive Red -3, -13, -16, -21, -22, -23, -24, -29, -31, -33, -35, -45, -49, -55, -63, 85, -106, -109, -111, -112, -1134, -114, -118, -126, -128, -130, -131, -141, -151, -170, -171, -174, -176, -177, -183, -184, -186, -187, -188, -190, -193, -194, -195, -196, -200, -201, -202, -204, -206, -218 and -221, C.I. Reactive Blue -2, -3, -5, -8, -10, -13, -14, -15, -18, -19, -21, -25, -27, -28, -38, -39, -40, -41, -49, -52, -63, -71, -72, -74, -75, -77, -78, -79, -89, -100, -101, -104, -105, -119, -122, -147, -158, -160, -162, -166, -169, -170, -171, -172, -173, -174, -176, -179, -184, -190, -191, -194, -195, -198, -204, -211, -216 and -217, C.I. Reactive Orange -5, -7, -11, -12, -13, -15, -16, -35, -45, -46, -56, -62, -70, -72, -74, -82, -84, -87, -91, -92, -93, -95, -97 and -99, C.I. Reactive Violet -1, -4, -5, -6, -22, -24, -33, -36 and -38, C.I. Reactive Green -5, -8, -12, -15, -19 and -23, and C.I. Reactive Brown -2, -7, -8, -9, -11, -16, -17, -18, -21, -24, -26, -31, -32 and -33; and

other dyes such as C.I. Basic Black -2, C.I. Basic Red -1, -2, -9, -12, -13, -14 and -27, C.I. Basic Blue -1, -5, -7, -9, -24, -25, -26, -28 and -29, C.I. Basic Violet -7, -14 and -27, C.I. Food Black -1 and -2.

[0101]

The above-described examples of the coloring materials are preferable for the ink of the present

invention, but coloring materials used for the ink composition of the present invention are not particularly limited to the above-described coloring materials. The dye used for the ink composition of the present invention is preferably contained in the amount of 0.1 to 50 mass% based on the total mass of the ink.

[0102]

[Additives]

Various additives or auxiliary agents can be added as needed to the composition of the present invention. One of such additives is a dispersion stabilizer, which stably disperses a pigment in a solvent. The composition of the present invention comprises a polymer having a polyvinyl ether structure, so that it has a function to disperse a granular solid such a pigment. When dispersion is insufficient, however, other dispersion stabilizers may be added.

[0103]

As other dispersion stabilizers, resins having both hydrophilic and hydrophobic parts, or surfactants can be used. A copolymer consisting of a hydrophilic monomer and a hydrophobic monomer is an example of such a resin having both hydrophilic and hydrophobic moieties.

[0104]

Examples of such a hydrophilic monomer include acrylic acid, methacrylic acid, maleic acid, fumaric

acid, the above described carboxylic acid monoesters, vinylsulfonic acid, styrenesulfonic acid, vinyl alcohol, acrylamide and methacryloxyethyl phosphate. Examples of such a hydrophobic monomer include styrene, styrene  
 5 derivatives such as  $\alpha$ -methylstyrene, vinylcyclohexane, vinylnaphthalene derivatives, acrylic acid esters and methacrylic acid esters. Copolymers with various structures, such as a random copolymer, block copolymer or graft copolymer, may be used. Naturally, hydrophilic  
 10 and hydrophobic monomers used herein are not limited to the above-described examples.

[0105]

Examples of the surfactant to be used include anionic, nonionic, cationic and amphoteric surfactants.  
 15 Examples of the anionic surfactant include a fatty acid salt, alkyl sulfate, alkylaryl sulfonate, alkyldiaryl ether disulfonate, dialkyl sulfosuccinate, alkyl phosphate, naphthalenesulfonic acid formalin condensate, alkyl polyoxyethylene phosphate, and glycerol borate  
 20 fatty acid ester. Examples of the nonionic surfactant include polyoxyethylene alkyl ether, a polyoxyethyleneoxy propylene block copolymer, sorbitan fatty acid ester, glycerin fatty acid ester, polyoxyethylene fatty acid ester, polyoxyethylene  
 25 alkylamine, a fluorine-based surfactant, and a silicon-based surfactant. Examples of the cationic surfactant include an alkylamine salt, a quaternary ammonium salt,

an alkyipyridinium salt, and an alkyimidazolium salt. Examples of the amphoteric surfactant include alkyl betaine, alkylamine oxide and phosphatidylcholine. In addition, surfactants are also not limited to the above  
5 examples.

[0106]

Further, an aqueous solvent may be added, as needed, to the composition of the present invention. In particular, when the composition is used for an ink for  
10 ink jetting, such an aqueous solvent is used also to prevent drying of the ink at a nozzle portion and consolidation of the ink. The aqueous solvent can be used singularly or in combination. The above listed examples of aqueous solvents can be used as such. In  
15 the case of an ink, the content of the aqueous solvent is within the range of 0.1 to 60 mass%, preferably 1 to 40 mass% based on the total mass of the ink.

[0107]

When the composition is used for ink, examples of  
20 other additives include a pH adjuster used to stabilize the ink and to achieve stable piping of the ink in a recording apparatus; a penetrant used to promote the penetration of the ink into a recording medium so as to hasten apparent drying; a fungicide used to prevent  
25 generation of molds in the ink; a chelating agent used to block metal ions in the ink so as to prevent deposition of the metal at a nozzle portion or

deposition of insoluble matters in the ink; an antifoaming agent used to prevent the generation of bubbles during the circulation or movement of a recording liquid or the production of the recording liquid; an antioxidant; a fungicide; a viscosity adjuster; an electric conductive agent; and an ultraviolet absorber.

[0108]

To prepare the ink composition of the present invention, the above constituents are mixed, and they are uniformly dissolved or dispersed. For example, a plurality of components are mixed, and the mixture is grounded and dispersed with a sand mill, ball mill, homogenizer or nanomiser to prepare an ink mother liquid, and solvents or additives are added thereto to adjust physical properties, thereby producing the ink composition of the present invention.

[0109]

Subsequently, the toner composition of the present invention will be described below. Specifically, the toner composition comprises a dispersion medium such as a binder resin, a coloring material and the above-described polymer compound having the repeating unit structure represented by the general formula (2) or (3).

[0110]

The content of the polymer compound having the repeating unit structure represented by the general

formula (2) or (3) in the toner composition of the present invention is generally within the range of 0.1 to 95 mass%, and preferably within the range of 0.5 to 80 mass%.

5 [0111]

Moreover, the polymerizable compound of the present invention can be used alone as a binder resin, or it can also be used in combination with another binder resin such as a styrene acrylic resin or  
10 polyester resin.

[0112]

Subsequently, components other than the polymerizable compound to be contained in the toner composition of the present invention will be described  
15 in detail. Examples of the other components include a binder resin, a coloring material (pigment or dye), a charge controlling agent, a mold release agent, an external additive and a magnetic particle.

[0113]

20 (Addition of other components to toner composition)

Examples of the binder resin include a styrene acrylic copolymer, polyester and polycarbonate. The content of such a binder resin is preferably 10 to 99 mass%. As the coloring material the pigments or dyes  
25 described for the above ink composition can be used. The content of such a coloring material is 0.1 to 50 mass%. Examples of the charge controlling agent include

a metal-azo complex, a triphenylmethane dye, nigrosine and an ammonium salt. The content of the antistatic agent is 0.1 to 30 mass%. Examples of the mold release agent include a synthetic wax and a natural wax.

5 Examples of the external additive include inorganic fine particles such as silica, alumina or titania, and resin fine particles such as polyvinylidene fluoride (PVDF) or polytetrafluoroethylene. Examples of the magnetic particle include magnetite, hematite and  
10 ferrite. The toner composition can function even when it does not contain all the above components, and may further contain components other than those described above.

[0114]

15 In order to prepare the toner composition of the present invention, for example, the above-described components are mixed, melted and kneaded, so as to obtain a homogeneous mixture, which mixture is then grounded with a speed mill or jet mill, and the  
20 obtained particles are classified by size, so as to obtain toner with a desired size. The external additive may be added to the toner, and the mixture is mixed with a mixer, so as to obtain the toner composition of the present invention.

25 [0115]

Next, the image formation method, liquid application method, and image formation apparatus that

use the composition of the present invention will be described.

[Image Formation Method, Liquid Application Method, and Apparatus]

5           The composition of the present invention can be used for various types of image formation methods and apparatuses, such as various printing methods, ink-jet methods or electrophotography. An image can be printed by the above image formation method using the above  
10   apparatus. Further, when using the liquid composition, a fine pattern can be formed by the ink-jet method, or such a liquid composition can be used for the liquid application method including administration of a medicine or the like.

15   [0116]

          The image formation method of the present invention is a method of forming an excellent image using the composition of the present invention. The image formation method of the present invention is  
20   preferably a method of discharging the ink composition of the present invention from an ink discharge unit to deposit it on a recording medium, thereby effecting recording. As the image formation method, the ink-jet method is preferably used which imparts a thermal  
25   energy to the ink to discharge the ink.

[0117]

          As the ink-jet printer using the ink-jet ink

composition of the present invention, there are used various ink-jet recording apparatuses such as a piezo ink-jet system recording apparatus using a piezoelectric element, or a bubble jet (registered trademark) system in which a thermal energy is imparted to an ink to generate a bubble, thus performing recording.

[0118]

The overview of the ink-jet recording apparatus will be explained below, referring to FIG. 1. However, FIG. 1 is only an example of the structure, and it is not intended to limit the present invention.

[0119]

FIG. 1 is a block diagram showing a structure of the ink-jet recording apparatus.

FIG. 1 shows a case where a head is moved to perform recording on a recording medium. In FIG. 1, an X direction drive motor 56 and a Y direction drive motor 58, which drive a head 70 in X and Y directions, are connected to a CPU 50 for controlling the entire movement of the recording apparatus via an X motor drive circuit 52 and a Y motor drive circuit 54, respectively. In accordance with instructions from the CPU, the X direction drive motor 56 and the Y direction motor drive motor 58 are driven via the X motor drive circuit 52 and the Y motor drive circuit 54, so that the location of the head 70 on the recording medium is

determined.

[0120]

As shown in FIG. 1, not only the X direction drive motor 56 and the Y direction motor drive motor 58, but  
5 also a head drive circuit 60 is provided to be connected to the head 70. The CPU 50 controls the head drive circuit 60 to drive the head 70, that is, to discharge the ink-jet ink. Moreover, an X encoder 62 and a Y encoder 64, which detect the location of the  
10 head, are connected to the CPU50, and the information regarding the location of the head is inputted in the encoders. Furthermore, a control program is also inputted in a program memory 66. The CPU 50 moves the head 70, based on the control program and the  
15 information regarding the location from the X encoder 62 and the Y encoder 64, so that the head is positioned at a desired location on the recording medium and the ink-jet ink is then discharged. Thus, a desired image can be formed on the recording medium. Further, in the  
20 case of an image recording apparatus that can be equipped with multiple ink-jet inks, the above operation is carried out for each ink-jet ink a given number of times, so that a desired image can be formed on the recording medium.

25 [0121]

Further, after the ink-jet ink has been discharged, the head 70 may be moved, as needed, to a location

where an ink removal means (not shown in the figure) for removing an excess ink attached to the head is provided, and the head 70 may be cleaned by wiping or the like. As specific cleaning methods, the  
5 conventional cleaning methods can be used as such.

After completion of the formation of the image, the recording medium on which the image has been formed is replaced with a new recording medium by a carrying mechanism for recording media, which is not shown in  
10 the figure.

[0122]

It is to be noted that in the present invention, the above-described embodiment can be changed or modified without departing from the spirit or scope of  
15 the invention. For example, although the head 70 is moved in the X-Y axes directions in the above explanation, the head 70 may be moved only in the X axis direction (or Y axis direction) while the recording medium may be moved in the Y axis direction  
20 (or X axis direction), and thus, the head and the recording medium may be moved relative to each other to form an image.

[0123]

The present invention especially exhibits  
25 excellent effects when applied to a head that has a means (for example, an electrothermal transducer, laser beam, etc.) for generating a thermal energy, which is

utilized to discharge an ink-jet ink, and discharges  
the ink-jet ink using the thermal energy. Such an ink-  
jet system enables formation of a finer image. By using  
the ink-jet ink composition of the present invention, a  
5 more excellent image can be printed.

[0124]

As the representative structure or principle of  
the apparatus having the above heat energy-generating  
means, basic principles disclosed in U.S. Patent Nos.  
10 4,723,129 and 4,740,796 are preferably used. This  
system can be applied to both the so-called on-demand  
type and continuous type. It is particularly effective  
to apply this system to the on-demand type. This is  
because, in the case of the on-demand type, at least  
15 one driving signal, which corresponds to a discharging  
information and gives a rapid increase in temperature  
that exceeds nuclear boiling, is applied to an  
electrothermal transducer located corresponding to a  
liquid path that retains liquid, so that a thermal  
20 energy is generated from the electrothermal transducer,  
thereby causing film boiling on a heat acting surface  
of the head, whereby an air bubble can be formed in the  
liquid in a one-to-one correspondence with the driving  
signal. By the growth and shrinkage of the air bubble,  
25 liquid is discharge via a discharging opening to form  
at least one ink droplet. If this driving signal is of  
a pulse-shape, the growth and shrinkage of a air bubble

is carried out rapidly and appropriately, so that liquid discharge that is particularly excellent in signal-responsibility can be achieved, which is more preferable. As such a pulse-type driving signal, those  
5 described in U.S. Patent Nos. 4,463,359 and 4,345,262 are appropriate. In addition, with regard to the above-described rate of raise in the temperature of the heat acting surface, when the conditions described in U.S. Patent No. 4,313,124 are adopted, more excellent ink  
10 discharge can be carried out.

[0125]

With regard to the structure of the head, not only the combined structure (a linear liquid path or right angle liquid path) consisting of a discharge port, a  
15 liquid path and an electrothermal transducer that is described in each of the above specifications, but the structure that a heat acting unit is located in a bending region, described in U.S. Patent Nos. 4,558,333 and 4,459,600, are also included in the present  
20 invention. In addition, the structure in which multiple electrothermal transducers use a common slit as a discharging unit, described in Japanese Patent Application Laid-Open No. S59-123670, or the structure in which an opening port for absorbing the pressure  
25 wave of thermal energy corresponds to the discharging unit, described in Japanese Patent Application Laid-Open No. S59-138461, is also effective for the present

invention. This is to say, regardless of the form of the head, an ink-jet ink can be reliably and efficiently discharged according to the present invention.

5 [0126]

Moreover, the present invention can also be effectively applied to a full line-type head having a length corresponding to the maximum width of a recording medium in the image formation apparatus of the present invention. The structure of such a head may be either a structure satisfying the above length by a combination of multiple heads, or structure as a single-piece head.

[0127]

15 In addition, the present invention is also effective for a serial type head, a head fixed to the main body of an apparatus, or an exchangeable chip type head which is equipped in the main body of an apparatus, thereby enabling electric connection with the main body or ink supply from the main body.

[0128]

Furthermore, the apparatus of the present invention may further comprise a droplet removal means. When such a means is added to the apparatus, further excellent discharging effects can be realized.

25 [0129]

Still further, preliminary assisting means is

preferably added to the apparatus of the present invention to further stabilize the effects of the present invention. Specific examples of such assisting means include a capping means for the head, a  
5 pressurizing or sucking means, a preliminary heating means for performing heating using an electrothermal transducer, other heating elements or a combination thereof, and preliminary discharging means for performing discharge other than the discharge of an ink.

10 [0130]

The above film boiling system is the most effective for the present invention.

In the apparatus of the present invention, the amount of the ink-jet ink discharged from each  
15 discharging port of the discharge head is preferably within the range of 0.1 to 100 picolitre.

[0131]

Still further, the ink composition of the present invention can also be used for an indirect recording  
20 apparatus using a recording system wherein an ink is printed on an intermediate transfer member and then transferred on a recording medium such as a paper sheet. Further, the ink composition of the present invention can also be applied to an apparatus using a direct  
25 recording system wherein such an intermediate transfer member is used.

[0132]

(Examples)

The present invention will be described in detail in the following examples. However, these examples are not intended to limit the scope of the present

5 invention.

[0133]

(Example 1)

<Synthesis of  $\text{CH}_2 = \text{CHOCH}_2\text{CH}_2\text{OPh}(4\text{F})\text{COOC}_2\text{H}_5$ >

25 parts by mass of pentafluorobenzoic acid ethyl  
10 ester and 21.6 parts by mass of  $\text{NaNO}_2$  were mixed in 200 parts by mass of DMSO, and the mixture was heated.

After the mixture was stirred at  $50^\circ\text{C}$  for 2 hours, it was cooled to room temperature, and 520 parts by mass of ice water was added thereto. Concentrated

15 hydrochloric acid was added to the mixture to adjust pH to 2, and the mixture was then heated to  $100^\circ\text{C}$  followed by stirring for 30 minutes. The mixture was cooled to room temperature followed by extraction with ether.

Organic layers were washed with water and dried with  
20 anhydrous magnesium sulfate. The solvent was removed, and the obtained residue was washed with hexane to obtain 4-hydroxy-2,3,5,6-tetrafluorobenzoic acid ethyl ester. 200 parts by mass of the obtained 4-hydroxy-2,3,5,6-tetrafluorobenzoic acid ethyl ester was

25 dissolved in 500 parts by mass of DMF, and an equivalent amount of NaH was gradually added thereto followed by stirring for 1 hour. 20 parts by mass of

tetrabutylammonium iodide was added thereto, 180 parts by mass of 2-chloroethyl vinyl ether was then added thereto, and the thus obtained mixture was stirred at 100°C for 10 hours. After cooling to room temperature, 5 the reaction solution was added to 4,600 parts by mass of ice water followed by extraction with ethyl acetate. Organic layers were washed with water and dried with anhydrous magnesium sulfate. The solvent was removed, and the residue was subjected to silica gel column 10 chromatography to obtain the objective polymeric compound. The NMR of the thus obtained polymeric compound is shown in FIG. 2.

[0134]

(Example 2)

15 <Synthesis of Polymer>

0.1 mol of the polymeric compound obtained in Example 1, 0.001 mol of water and 0.005 mol of ethyl aluminum dichloride were subjected to cationic polymerization in anhydrous toluene.

20 After 20 hours the reaction was completed, and methylene chloride and water were added to the reaction product, and the mixture was washed with water and then with diluted hydrochloric acid, and further washed with alkali. Thereafter, the thus washed product was dried 25 with anhydrous sodium sulfate, and the solvent was removed to obtain a polymer compound (polymer). The number-average molecular weight of the polymer measured

by the size exclusion chromatography was 2,500.

[0135]

(Example 3)

< Synthesis of  $\text{CH}_2 = \text{CHO}(\text{CH}_2\text{CH}_2\text{O})_2\text{Ph}(4\text{F})\text{COOC}_2\text{H}_5$  >

5           The synthesis was carried out in the same manner as in Example 1 with the exception that  $\text{CH}_2 = \text{CHOCH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{OTs}$  (wherein Ts represents a tosyl group) was used instead of 2-chloroethyl vinyl ether of Example 1 to obtain the objective polymeric compound.

10   [0136]

(Example 4)

          Using each polymeric compound obtained in Example 3, the polymerization was carried out in the same manner as in Example 2 to obtain a polymerizable  
15   compound. The number-average molecular weight of the polymerizable compound measured by the size exclusion chromatography was 1,800.

[0137]

(Example 5)

20           The polymer compound (polymer) synthesized in Example 2 was mixed with a 5N aqueous sodium hydroxide solution, and the mixture was stirred at room temperature (23°C) for 40 hours, so that ester was hydrolyzed. The solution was neutralized with 5N  
25   hydrochloric acid, extracted with methylene chloride, and dried. Thereafter, the solvent was removed to obtain a free carboxylic acid polymer. The obtained

polymer was neutralized with an equivalent amount of 1N sodium hydroxide, and water was then removed to obtain a sodium carboxylate polymer.

[0138]

5 (Example 6)

2 parts by mass of pigment (product name: Mogul L, manufactured by Cabot Corp.), 3 parts by mass of the sodium carboxylate polymer of Example 5, and 25 parts by mass of diethylene glycol were added to 177 parts by mass of ion exchange water, followed by dispersion with an ultrasonic homogenizer. The dispersion solution was subjected to pressure filtration using 1  $\mu$ m filter to prepare an ink composition. The pigment had good dispersibility.

15 [0139]

(Example 7)

<Synthesis of  $\text{CH}_2 = \text{CHOCH}_2\text{CH}_2\text{OPh}(2\text{F})\text{COOC}_2\text{H}_5$  wherein two fluorine atoms are substituted at positions 3 and 5 of benzoic acid>

20 The objective compound was synthesized using  $\text{HOPh}(2\text{F})\text{COOC}_2\text{H}_5$  in the same manner as in Example 1. Using the obtained compound, a polymer was synthesized in the same manner as in Example 2.

[0140]

25 (Example 8)

Using the ink composition prepared in Example 6, ink-jet recording was carried out. An ink tank of a

bubble jet (registered trademark) printer (product name: BJJ-800J) manufactured by Canon Inc. was filled with the ink composition of Example 6. Using this ink-jet printer, recording was carried out on a plain paper  
5 sheet. As a result, clear black printing was achieved.

[0141]

(Example 9)

Using the free carboxylic acid polymer that is a precursor of the sodium carboxylate polymer obtained in  
10 Example 5, a toner composition was produced by the following method.

100 parts by mass of polyester resin (bisphenol A, terephthalic acid, n-dodecenylsuccinic acid, trimellitic acid and diethylene glycol were synthesized  
15 at a molar ratio of 20 : 38 : 10 : 5 : 27), 70 parts by mass of magnetite ( $\text{Fe}_3\text{O}_4$ ), 3 parts by mass of the above described free carboxylic acid polymer, 2 parts by mass of triphenylmethane dye, and 3 parts by mass of low molecular-weight polypropylene were preliminarily mixed,  
20 and the obtained mixture was melted and kneaded with a ruder. After cooling the resultant product, it was roughly grounded with a speed mill, and then finely grounded with a jet mill. Thereafter, the particles were classified using a zigzag separator to obtain  
25 toner having a volume mean diameter of 11  $\mu\text{m}$ .

[0142]

0.4 part by mass of positively-charged hydrophobic

dry silica treated with amino-modified silicon oil  
(having viscosity at 25°C of 100 cp and amine  
equivalence of 800) and 0.2 part by mass of spherical  
PVDF particles having a mean particle size of 0.2  $\mu\text{m}$   
5 were added to 100 parts by mass of the above obtained  
toner. Thereafter, the mixture was blended with a  
Henschel mixer, so as to obtain a positively charged  
toner composition. Using this toner composition,  
printing was carried out with a printer NP-3525  
10 manufactured by Canon Inc. As a result, clear printing  
was achieved.

[0143]

[Effect of the Invention]

As described above, by polymerizing the novel  
15 polymerizable compound according to the present  
invention, it is possible to provide a polymer compound  
which is suitable for improving the dispersion  
properties of a coloring material and a solid matter,  
thereby to preparing an ink composition or a toner  
20 composition.

Further, the polymer compound according to the  
present invention, by mixing with a solvent or  
dispersion medium and a coloring material, makes it  
possible to provide compositions such as an ink  
25 composition or a toner composition and a recording  
material.

In addition, there can be provided an image

formation method and apparatus using a recording material such as an ink composition or a toner composition using the polymer compound according to the present invention.

5 [Brief Description of the Drawings]

[Figure 1]

A block diagram showing the structure of an ink-jet recording apparatus.

[Figure 2]

10 A diagram showing NMR of the polymerizable compound of Example 1 of the present invention.

[Explanation of Reference Numerals]

20: ink jet recording apparatus

50: CPU

15 52: X motor drive circuit

54: Y motor drive circuit

56: X direction drive motor

58: Y direction drive motor

60: head drive circuit

20 62: X encoder

64: Y encoder

66: program memory

70: head

[Name of the Document] Abstract

[Abstract]

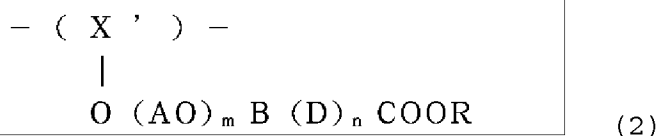
[Object]

To provide a polymer compound which is suitable  
 5 for improving the dispersion property of a coloring  
 material and a solid matter in an ink composition or a  
 toner composition.

[Means for attaining the object]

A polymer compound is provided which has a  
 10 repeating unit structure represented by the general  
 formula (2):

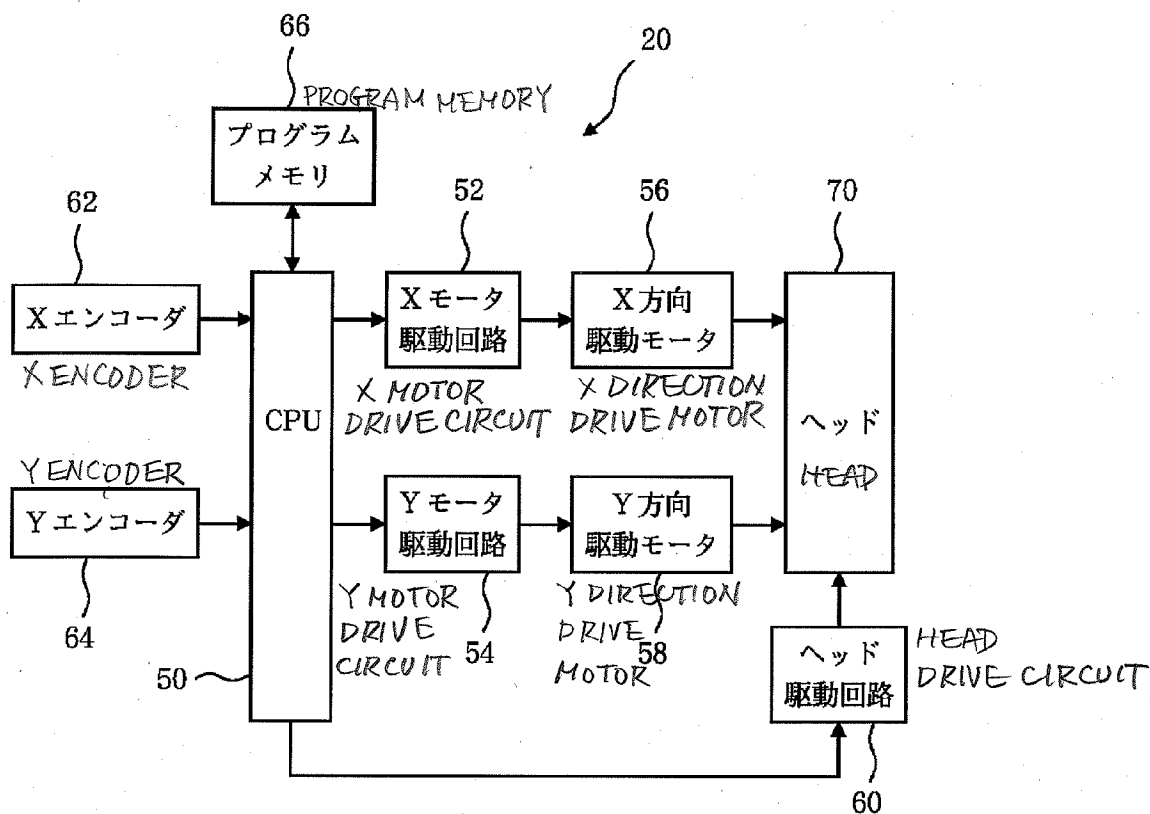
[General Formula (2)]



wherein X' represents a polyalkenyl group; each A  
 15 represents independently a linear or branched alkylene  
 group of 1 to 15 carbon atoms which may be substituted;  
 m represents an integer of 0 to 30; B represents a  
 single bond or an alkylene group which may be  
 substituted; each D represents independently an  
 20 aromatic ring in which at least one hydrogen atom  
 attached to the ring is displaced by a fluorine atom; n  
 represents an integer of 1 to 10; and R represents a  
 hydrogen atom, an alkyl group which may be substituted,  
 or an aromatic ring which may be substituted.

25 [Suggested figure for publication] None

【書類名】 図面  
[Name of the Document] Drawings  
【図1】 [Fig. 1]



【図2】 [Fig. 2]

